

Collected Works on Qigong Science  
(Volume 1)

Edited by Hu Hangchang and Wu Qihui

Beijing University of Science and Engineering Press

## Contents

Today And Furture-Some thoughts About Qigong ..... Zhang Zhenhuan, Tao Zulai.	page 4
Experimental Research About the Neural Mechanisms Of Qigong State And The Effects Of The Emitted Qi ..... Liu Guolong, Cui Rongqing et al	Page 11
Initial Approached On Neural Mechanisms Of Qigong State Take Auditory Evoked Responses As Index ..... Cui Rongqing, Liu Guolong	page 23
The Evoked Electrospinograph And Somatosensory Evoked Potential Changes On Qigong State ..... Peng Xueyan, Liu Guolong.	page 36
The Mutli-Information Processing Of EEG Under The Action Of Qigong ..... Wu Qiyao, Huang Kunhuo et al	page 56
The Application Of AR Model In Feature Extraction Of EEG In Superquiescence ..... Hong Zhi, Hu Zhongji et al	page 65
EEG Coherence And Topograpy In Superquiescence State ..... Wang Wei, Zou Bomin et al	page 79
The Analysis Of The EEG Chaos During Train-Qigong Process ..... Hu Xiehe, Hu Zhongji	page 99
※ ※	
The Effects Of Qi On The Raman Spectra Of Tap Water,	



Saline And Glucose Solution	page 106
..... Yan Xin, Li Shengping et al	
The Effects Of Qi On The Polarization Plane Of A Laser Beam	page 118
..... Yan, Xin, Lu Zuyin et al	
The Influences Of Qi On The Phase Behaviors Of Liposome And Liqui Crystal	page 135
..... Yan Xin, Zhao Nanming et al	
The Hyperchromic Effect Of Nucleic Acid Solution Induced By Qigong ...	page 144
..... Yan Xin, Zheng Changxue et al	
The Disproportionation Of CO And H Mixture Induced By Qigong	page 159
..... Yan Xin, Li Shengping et al	
The Substitution Of n-Hexane By Bromine Induced By Qigong	page 173
..... Yan Xin, Li Shengping et al	
The Initial Observation Of Qigong On The Affect OF Reaction Of Some free Radical	page 183
..... Guo, Shuhao, Zhang Zuqi et al	
Analysis On EEG Power Spectrum During Qigong States And The Effect Of The Emitted Qi Released By Qigong Master	page 193
..... Niu Xin, Liu guolong et al	
The Influence Of Emitted Qi On The Auditory Brainstem Evoked Responses And Auditory Middle Latency Evoked Responses In The Cat	page 206
..... Liu Guolong, Wan Pei et al	
Fine Structural Observation Of Emitted Qi Effective On Cancer Of Lung Of Mouse	page 216
..... Feng Lida, Guan Yingpeng et al	
Molecular Biological Effects Of Emitted Qi On Man	page 338
..... Luo Sen, Chai Shaoai et al	

The observation of Emistted Qi on the cytoplasm activity of the Hydrilla verticillata .....	Zhang Zuai.	page 221
The Probe of Measuring the Biological Effects of External Qi of Qi of QiGong by the Skill of Tradescantic Pulo- dusa Micronucleus .....	Sun Silu, Tao chun	page 229
Visualizion Study of effects of Emitted Qi .....	Luo Minghui, Yan Mingshan	page 233
The Research of Electronmagnetic waves Radiation by Man Body .....	Wang Yiyun, Zhang Liande	page 238
Experimental Research About The Infrasonic Characte- ristics of Qigong and Psi .....	Zhu Zhongxiang, Wang Xiobi et al	page 247
※ ※		
Effects of Qigong on Excretion of Urinary Catechola- mines .....	Tang Cimei, Yu Xixiang	page 260
The Effects of Qigong on Stress responses .....	Tang Cimei, Zheng Lianxing et al	page 265
The Bidirectional Adjustment of Daoyin Tuna Qigong (DTQ) on the Areterical Blood Pressure and Heart Rate .....	Qin Chao, Feng Yangzheng et al	page 275
Observation on the Effect of Lowerinc Blood Fat by Qigong of "TUNA DAOYIN" ...	Liu Yuanliang	page 279
Primary Study of Effects of "Qi Moving Method" on Some Functional Indexes of Endocrinopathy of Children .....	Hu Mingyou, Yang Yunliang et al	page 284
Effects of Zhoutian Minmen Gong on Malignant Tumour .....	Luo Sen, Tong Tianmin et al	page 288
The Clinical Efficacy and Mechanism Approach of		

Eye's Qigong exercise to Treat Myopia	page 296
..... Wang Yuqin, Zhang Guifang et al	
Preliminary Study on Qigong and Immunity	
..... Xu Hefen, Qi Yueqin et al	page 308
※ ※	
Chinese Qigong and Synergetics	..... Li Fuli
A Trial of the Phenomenological Theory of Jing-Luo	page 313
..... Hu Haichang	page 326
The Influence of Qigong On Stefan-Boltzmann Law	
..... Xie Huanzhang	page 346
The Statistical Treatment of the Experimental Results	
with Emitted Qi	..... Lu Zuyin, Li Tipei
	page 361

### Summary of Contents

This collection was compiled by an editorial group from the China Qigong Science Research Committee and the editorial committee of the Journal of Qigong Science. They compiled papers selected from those presented at the first All-China Qigong Science Academic Exchange Conference held in Xingcheng, Liaoning Province in August 1987 and ones from after the Xingcheng conference which are representative of qigong research. There is a total of 36 articles, reflecting the situation and achievements of current scientific research into qigong. The publication of this edition will help to strengthen academic exchanges in qigong science and promote further advances in scientific research into qigong.

This collection is aimed at those engaged in qigong science, researchers in the sciences of the human body and life sciences, those with a love of promoting qigong, and those who have benefited from its practice.

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(Volume 1)

Edited by Hu Haichang and Wu Qihui

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## FOREWORD

Qigong in our country has a long history and an immensely deep foundation among the masses. The number of persons in China who have studied, cared about, and loved qigong reaches into the tens of millions. Moreover it has attracted widespread attention from many well-known scientists both here and abroad. In particular, since 1978 a large number of scientific workers in China have been working to combine traditional qigong and modern science and use modern scientific techniques and methods to study qigong. Towards this end they have conducted much testing and have extensively begun research into the effects of qigong in physiology, biology, biochemistry, physics, and other areas. This research has forcefully proven the objective nature and value of qigong and taken this ancient Chinese treasure — the continuation and development of qigong — and pushed it to a new stage of modern qigong science research.

Noted scientist Qian Xuesen has highly praised the significance, position, and future of modern qigong science research. He correctly points out that "qigong science is a new scientific high technology" and predicted that qigong science research will give birth to "a new scientific revolution". Guidance and support from Qian Xuesen, Bei Shizhang, Zhao Zhongyao, and others of the old generation of scientists has urged China's qigong science research on further to deeper, broader developments. Today, more and more experts from all professions are joining the ranks of the researchers and cooperating closely with the qigong world to go forward hand in hand, strengthening China's qigong science research day by day.

In August 1987, the first meeting of the All-China Qigong Science Academic Exchange Conference was held in Xingcheng, Liaoning Province. It appropriately reflected the accomplishments in China's qigong science research over the past several years and received great attention from every part of society. In order to satisfy the great readership's study and research demands, the China Qigong Science Research Committee and the editorial committee of the Journal of Qigong Science compiled this collection from papers selected from those presented at the Xingcheng conference and ones published afterwards which are representative of Qigong research. We believe that this book will help to strengthen academic exchanges in qigong science and promote further advances in scientific research into qigong. From now on we will continue to use the vehicles of "collections" and "journals" to reflect the state and achievements of current scientific research into qigong to our readers.

This volume was edited by Hu Haichang and Wu Qihui. Also participating in the compilation were Xie Huanzhang, Tao Zulai, Wang Yonghuai, and others.

The collection editorial group of the China Qigong Science Research Committee and the editorial committee of the Journal of Qigong Science.

June 1988

## Today and Future — Some Thoughts on Qigong

Zhang Zhenhuan and Tao Zulai

At present, the tide of qigong is surging in China. Experimental observations of the many aspects of the "qi state" have greatly opened up understanding of our own selves and lives. The experimental verification of the effects of qigong on different levels has further moved people towards a vast and hope-filled frontier. Science's experimental proof has opened a great door for ancient qigong to flow into the present age.

With the gradual dissolution of the dark clouds of "magic" and feudal superstition which covered it, a vast, mass-style qigong movement is now arising in China. Mass-style practices numbering in the millions are having benefits and effects for society which are difficult to estimate. Qigong is entering deeply into thousands upon thousands of households, deeply influencing people's lives, and becoming an indispensable component of life.

The needs of society are illuminating the youthful vigor of qigong. Many people with unrevealed talents and amazing abilities have gradually had these talents brought to light. Not a few elders, inactive for many years, have thrived when the time came for them to act. The world of qigong, which has lain quiet for the last hundred years, has begun to revive. People are using new eyes to reexamine ancient and mystical qigong and to recognize anew an ancient Oriental culture.

Correspondingly, there has been a fundamental change in qigong's position in society. Ten years ago, the qigong waking exercises in the public parks were looked on as witchcraft and suffered suspicion and attacks. Today the entire nation, from the central government down through the provinces, municipalities, districts, and counties has established qigong research committees or qigong associations. Moreover, the State Education Commission has stipulated that qigong be entered into the state educational track. Qigong courses have also been entered in the guide of the State Natural Sciences Foundation and it has gained first place within the field of scientific research. What a change in only ten years!

This series of changes signifies that the development of our nation's qigong profession has entered a new stage. In this new stage it is demanded of us that we make a historical examination from the height of development of human civilization. This requires us to make a realistic estimate of the course we have walked and to carry out a strategic consideration of our future path. The key to the problem is comprehension of "qigong" and an understanding of the relationship between "qigong" and the future development of human civilization.

So just what is it that we call qigong? We consider that since the qigong state is the state possessed by the movement of human life. So qigong is a treasure common to all of humanity. In the different periods of the development of human civilization it has had differing historical connotations. Indeed, in remote antiquity the practice of qigong was our ancestor's basic method of understanding the world and of improving themselves (through scholarly study and moral cultivation). And indeed it was hugely useful in the creation and development of ancient civilization. However, owing to the limitations of methodology and the restrictions of historical conditions, it underwent a transformation during the long feudal period from "higher learning" to "practices"; gradually it descended into the realm of religion and was demoted to being the handmaiden of theology. And it tended to decline under the impact of modern culture. However, it was exactly the modern scientific techniques representing the high development of modern civilization which gradually revealed the limitations of the methodological foundation of modern civilization and aroused peo-

ple's interest in ancient Oriental civilization. In addition, the veil of mystery was also gradually lifted by a series of rigorous scientific examinations of phenomena which are unexplainable but which do exist; this allowed qigong to return to earth from dreamworld of the beyond. Not only that, but the high development of science and technology and modern civilization has laid the material foundation for a leap by humanity to a future civilization which takes the human body and life as its object. As Marx said "In actuality, the realm of freedom only begins where the labor which is stipulated as necessary by essentials and external purposes ends; according to the value of things, it is that which lies on the far shore of the realm of true material production". "Only on the far shore of this realm can development of the human ability, with its self as the goal, the realm of true freedom, begin. Moreover, the realm of freedom will only begin to flourish when it is established on this necessary foundation." Therefore with the view of the future development of human civilization with humanity's own potential as the goal, the significance of qigong lies in that for the life of man's own self, it is the path from the realm of necessity to the realm of freedom.

"A journey of a thousand miles begins with a single step". The future leap from "necessity" to "freedom" starts with our beginning to practice today. For qigong, this includes three areas:

ONE Increase qigong science research and bring on the scientific revolution of the future.

True, fundamental differences in methodology and epistemology exist between the study of qigong and modern science which at present are difficult to reconcile. Under these conditions, it is difficult to fit qigong and the study of qigong within the scope of modern science and "science-ize" it. This would be impossible as well as unnecessary. We say that modern science is incapable of encompassing qigong. This is not to imply the elimination of scientific research into qigong; on the contrary, it is only through forceful development of multidisciplinary combined research into qigong phenomena, while keeping in mind the fundamental methodological differences between the two, that the study of qigong and modern science will be able to combine to reach new heights. This is because:

(1) The movements of human life are a combination of many forms of mechanical, physics, chemical, and biological and mental movements. With so many different types of movement it is only possible to gain a true understanding of them by using the appropriate corresponding methods. The sage Laozi said "use the body to observe the body, use the home to observe the home, use the village to observe the village, use the nation to observe the nation, and use the world to observe the world". This has the same meaning as what we just discussed. Thus the rather low levels of the movements and changes of state involved in qigong necessitate using modern scientific methods to study them; the methods of traditional qigong study are no substitute. Only on the basis of gradually solving the low-levels and parts of the problem will it be possible to penetrate to the higher levels and expose the heart of qigong. This is the only correct way to pose the problem, and correctly posing the problem is always half of the solution.

(2) Only by "using a rigorously scientific eye in examining these inexplicable yet incontestable phenomena" can the existence of these mysterious phenomena be confirmed by scientific proofs. And only then will qigong be freed from the chains and fetters of feudal superstition. These are the conditions necessary for venerable qigong to be accepted by modern times and modern peoples. The history of qigong since the establishment of the Peoples Republic of China is enough to explain this point.

(3) Without proof from modern scientific experiments as to the existence of the

between qigong phenomena and the theories of modern science, existing scientific norms, and the foundations of the methodology of modern science. And in the process, gradually establish methodological norms for qigong science research so as to make preparations for the transformations of the future.

(3) Find applications. The scope of applications for qigong is extremely broad. While we are displaying qigong's uses in harmonizing the mind and body, building health, and eliminating disease, we should particularly stress: for young people, the wise development and improvement of the quality of the entire race; urging the building of spiritual civilization; and combining qigong and modern science for direct application to production practices and to creating even greater economic benefits. If one wishes to find the main avenue of attack for qigong science research for the present, then we feel that there two points are the major topics for present qigong research. In this area, the experiment to refine strains of bacteria which Li Shengping of Qinghua University and Doctor Yan Xin collaborated on was an extremely valuable attempt. If it had been able to actually apply it to production practices it would have opened a new area for work on qigong.

We advocate that scientists and qigong experts cooperate closely, with consciousness, purpose, and planning, to develop every area of work in scientific experiments and production experiments. The future prospects are extremely enticing and the road ahead is a very wide one.

TWO With a foothold in the present and an eye on the entirety of China's ancient civilization, establish a theoretical system for the traditional study of qigong to accord with the needs of the present.

Our ancestors left us a rich legacy in qigong. It is without a doubt a magnificent treasure. To systematically discover, sift through, and carry on this precious legacy is indeed a major duty of the present-day work in qigong; it is also where our superiority lies. However, classical qigong has cumbersome and jumbled systems, a multiplicity of different schools, and bears deep historical branding. Therefore, faced with this abundant treasury we must first decide a question of how to carry it onwards. If this question is answered poorly then this rich legacy will become a millstone around our necks, making it impossible for us to take a step and leaving us at a loss as to what to do.

How then should we treat the legacy of ancient qigong? The key lies in two points, where to plant our feet and where to direct our gaze. For the former, we must have both feet planted in the present, and as for the latter, we feel that we should keep the entirety of China's ancient civilization in view.

To plant our feet in the present is simply to be based in the needs of modern man vis a vis qigong, and to have a foothold in modern civilization and in the social practices of modern man. What the present age needs from qigong is to see qigong as understanding the entirety of the motions of life in man as well as one kind of effective method in the relations between man and nature, and to see it as realizing self control over the motions of life of his own body. It needs to see qigong as the way from the realm of necessity into the realm of freedom, but not as a means of ascending to the heavens as a Taoist immortal or achieving nirvana as a buddha. The reform of goals, the progress of civilization, and the development of society must be directed towards the evolution of qigong itself. Historical research tells us that qigong in any historical period bears the brand of that era. As an example, take this short passage from the "The Yellow Emperor's Secret Scripture • Simple Questions • Discussions on Ancient Heavenly Truths": The Yellow Emperor said, I have heard that in far ancient times there were true sages who beheld heaven and earth, who grasped the Yin and the Yang, who breathed pure qi, who independantly watched over gods,



whose flesh and muscles were as one, .....; in near ancient times, there were virtuous sages who were pure in virtue and completely in the Way, in harmony with the Yin and Yang, harmonized to the four seasons, rid of the world and apart from worldly things. They accumulated purity to be fully gods, walked between heaven and earth, saw and heard beyond the eight directions. This was of excellent benefit to their longevity and life, both of which were strong, and they likewise belonged to the sages. In the present times there are worthies, who can follow the ways of heaven and earth, appear as the sun and moon, distinguish between the stars and planets, go with or against the Yin and Yang, distinguish the four seasons, do as in ancient times, and be in accordance with the Way. They also cause their life to be long. In the present times there are wise men, beyond the harmony of heaven and earth, following the reasonings of the eight winds, pursuing desires for worldly things, possessed of a heart without worry or anger, and travelling without desiring to leave this world. With ceremonial dress he lifts up his hands, not wishing to look upon worldly things. On the outside there is no appearance of weariness with affairs, on the inside there are no thoughts about evil; he carries out his affairs with tranquility and does labor with contentment. His body is not worn down and his spirit is not dissipated; he too will live to be one hundred." This short passage makes use of the mouth of the legendary Yellow Emperor. It discusses, in summary, the evolution of qigong in the short historical period from far antiquity up to before the destruction of all the books by the Qin, the First Emperor [3rd century B.C.]. From the true sages through to the wise men, the societal content of qigong has grown and become more important. The evolution of qigong clearly bears the traces of human social development and the progress of material civilization. From the past to today this short passage tells us that when we speak of continuing the legacy of China's ancient qigong, we must remain rooted in the present and be intelligent in coming up with new ideas! The goal of this continuation lies in creating new ideas, as it is only through new ideas that we can continue.

As for the problem of where to fix our gaze, just as we stated above the practice of qigong was one of the basic means by which the ancients understood the world. Thus qigong is inseparable from Chinese classical culture's theory of knowledge and methodology. It was one of the inseparable components of ancient Chinese culture. Establishing a theoretical system for classical qigong therefore requires that we look upon the whole of China's ancient culture from the viewpoint that it is "learning" (that is to say, as a branch of higher learning rather than a type of sleight of hand). A systematic uncovering and ordering must be conducted from the full breadth and depth of history. We absolutely cannot limit our vision to the formulas in qigong's treatises and secret works, otherwise we will find it difficult indeed to throw off its stereotype as a "magic art" and might be pulled down into the whirlpool of interfactional competition.

It should also be pointed out that establishing a theoretical system for traditional qigong and perpetuating the legacy of ancient qigong does not in any way run counter to scientific research into qigong; on the contrary, it is complementary. In fact, it is precisely the existential proof of qigong provided by modern scientific experiments and the establishment of the concept of the "qigong state" which provide us with the basis from which to reacquaint ourselves with qigong and with China's ancient culture.

**THREE** Widespread, multi-level, multi-aspected mass-style practice of qigong is the foundation for China's qigong work.

This includes three major areas:

(1) Popularize qigong, so as to let even more people have the experience of qigong practice. In particular, we want to let more people with a high level of attainment in the

modern scientific culture to have the experience of practicing qigong, so that the two methods of understanding the world can be combined organically in the very selves of the people who practice them. This may be the most effective road to facilitating the merging of these two opposite and mutually antagonistic methodologies. With a group of people experienced in both practices, we will then be able to form an "organized and accepted" set of standards and guiding principles.

(2) Bring together qigong practices and the social practices of modern man in order to improve the quality of man and to raise the quality factors of people's lives, thus uniting qigong practice with the eventual goal of human civilization — to make people's lives better and thus inevitably bringing great social benefits and influences. In this area, it is worthwhile to draw lessons from the ways of improving one's body, cultivating one's mind, and control one's qi of the pre-Qin dynasty Confucians.

(3) Make qigong a discipline combining traditional qigong techniques and modern scientific techniques and apply it to the health of mind and body, intellectual development, and to direct production practices for directly creating prosperity for society. It must be noted that these three areas all depend on modern scientific research into qigong opening the way. And therefore strengthening scientific research into qigong is not merely for the needs of the present or for a tactical defence, but a strategic direction, a long-term plan. We must organize and lead the way for the world.

To conclude, let us remember a good passage from Xunzi; he said: "If small strides do not accumulate, they cannot reach to a thousand miles; if small streams do not accumulate, they cannot form rivers and oceans; the thoroughbred leaps once, then cannot take ten steps; the nag makes ten drives, and its effort is not exhausted. If you carve until you are tired you will not cut even rotted wood, but if you carve without flagging then even metal and stone can be engraved." Only if we walk without resting and carve without flagging in experiments in qigong science, in popularizing mass-style qigong training, in practicing applying qigong in medicine, teaching, and production, in discovering, ordering, and reacquainting ourselves with classical qigong theories, and in practicing perpetuation and creativeness in qigong will our droplets join into streams and run to form seas and take human civilization surging to a new peak.

"One without profound aspirations cannot shine brightly"; one who does not fear becoming absorbed in work must have "achievements most glorious"!

(This paper was read by Chairman of the Board Zhang of the China Qigong Science Research Committee at the establishment ceremony of the China Qigong Science Research Center on May 5th, 1988.)

## Experimental Research On The Qigong State And The Effects Of Emitted Qi on Neural Mechanisms

Liu Guolong Cui Rongqing Niu Xin Peng Xueyan  
(Beijing College of Traditional Medicine)

The history of qigong is a long one, flowing with a multitude of varying schools. In applications for strengthen the body, removing disease, and other applications there is little difference between them. According to the different ends for qigong, it can be differentiated into the two major categories of internal and external. No matter whether one are speaking of internal qigong or external qigong, it can be seen that there is a particular functional state which is the basis of the body's normal functional state; it is called the qigong state. The qigong state characteristic of internal gong is that of entering into tranquility. External gong has as its characteristic the dissemination of qi or the emission of external qi. The former is called the internal qigong state; the latter is the external qigong state. Both the internal and external qigong states can bring into play latent functions which the organism is not able to manifest under normal conditions — a supranormal state. One can assume that the internal qigong state, the external qigong state and the human body's extraordinary functions are special functional states which probably have a similar basis but which manifest themselves in different forms or at different functional levels. It is common knowledge that every function of the human body is controlled by the nervous system. Therefore to expound on the substance of the special functional state which is the qigong state, one must first research the functional conditions of the the central nervous system under the qigong state. This may be one of the major means of removing the "veil of mystery" from qigong.

In his paper entitled "The Science Of The Human Body Is A Major Discipline in the Modern Science and Technology System", Professor Qian Xuesen correctly points out that the excellent functions of qigong in the human body are an important content of the science of the human body, and that qigong is a particular functional state of the human body. Discussion of the qigong functional state provides important guidance for using modern science and technology to research the mechanisms of qigong. <sup>(1)</sup>

The high degree of coordination of an organism's functions is effected by the central nervous system. This function's manifestation uses the nervous system's most basic active forms, excitation and restraint—the relative balances of the nerve process—as its basis. The state of normal function is in setting the balance of the normal functions using feedback under automatic control, which are constantly set within a relative balance which is hard to exceed. If this boundary is crossed, then there is an abnormality. For instance, the mechanisms of metabolic balance, arterial pressure, heart rate, and body temperature are constant and relative. When these functions are in the special functional state of the qigong state, they produce something, under the control of the central nervous system, which is unattainable under normal conditions: new relative balances—the special qigong state. This functional state may express a lower than normal function state or it may express a higher than normal function state, or even extraordinary capabilities. Yoga, for instance, can maintain an organism in long-term existence under low-oxygen conditions, possibly by using a lower than normal function state in lowering its metabolic balance and reducing its level of oxygen consumption. Under the qigong state the organism would produce greater than normal capability, enabling it to endure strong shocks under abnormal conditions. The extension of external qi is one manifestation of an organism's supra-normal function state; it is produced as a type of biological information. As to what emitted (or external) qi is, is presently still a secret, but it can at least be affirmed that external qi does subjectively exist, that it

is of value, and that it contains certain energy level "information". It can not only be emitted from the human body, but can at the same time be received by the body and produce subjective effects. Not only is it the product of a supra-normal function state, but at the same time it is also biological information about the changes in the organism's functional state. At present, measurements of the effects of external qi using modern scientific technology have already discovered infrared radiation, electromagnetism, and other effects which occur in conjunction with emitted qi. This is only one objective proof of the material nature of external qi, and it is still far from explaining its essence and its effects. Probing into the effects of external qi in physics, chemistry, and biology, therefore, will be of great benefit in further understanding what external qi is. Lu Zuyin of Qinghua University and others have used advanced scientific techniques to persuasively prove the material nature and objective effects of emitted qi. They discovered that emitted qi can cause deflection of liquid crystal rays and used laser raman spectrography determination to prove that emitted qi can produce changes in water, 0.9% NaCl, 5% Glucose, and other chemical compounds <sup>(2,3)</sup>. Similar methods were also used to investigate the changes which emitted qi produced in the structure of artificial lipid (DPPC) membranes <sup>(4,5)</sup>. These experiments proved the objective effects of emitted qi at the biological molecular level. Feng Lida and others have used cell immunology techniques and electron microscope techniques to observe the biological effects of external qi at the cellular level <sup>(6,7)</sup>. It is commonly known that the cell is the basic unit of the life activities of living things. External qi's effect on cells and biological membranes must certainly change the cell's functioning. Bioelectrical phenomena is a major characteristic of excited cell activity; the regular pattern of external qi's changes of cell bioelectric activity is predictable. To sum up, it is reasonable to recognize that the qigong state is a special functional state of the human body and it is very probably based on and produced by regular patterns of activity at the molecular and cell level. Our laboratory employed methods of neuroelectrical biology, using changes in the evoked potential of the central nervous system and the potential of brain's own electrical emissions (EEG) as an index, to quite systematically observe the internal qi state, external qi state, and emitted qi through the different levels of the peripheral nervous system, spinal cord, brain stem, and cerebral cortex. This was in an attempt to lay down a foundation for further probing of the neural mechanisms of the qigong state.

#### ONE — The effects of internal qi on the evoked response of the cortex.

Stimulation of peripheral receptors, recorded on the surface of the scalp as changes in electrical potential called evoked potential, can come from all types of stimulation, such as sound, light flashes, pictures, and body-senses. Electrical potential evoked by different stimuli have a certain area and spatial distribution in the cortex, and thus the changes in potential which different stimuli evoke express the activity in different regions of the cortex. This experiment used all types of different evoked responses as an indications by which to make a fairly comprehensive observation of all sorts of changes in potential evoked from the cortex by a qigong master doing qigong exercises before, during, and after the qigong state. Changes in the components of the middle latent time (10~50ms) during the evoked responses of the auditory region of the cortex were observed in a series of eleven test subjects. The normal middle latent time of the auditory region of the cortex (MLR) is formed from the three positive-negative-positive phase waves, or Po, Na, Pa, which belong to the visual region of the cortex's primary response. When the test subjects entered the qigong state, the three components all had decreases in different ranges, of which that of the Na was the most pronounced, averaging a drop of 72%. All seemed to recover after the qi-

gong state (see fig. 1, C). In another eleven test subjects changes in components of the auditory region of the cortex slow response (SVR), namely the long latent time (50~300ms), was determined. The normal SVR is formed from the P<sub>1</sub>, N<sub>1</sub>, P<sub>2</sub>, N<sub>2</sub>, and N<sub>2</sub> waves of which the N<sub>2</sub> component, with a latency of about 200ms, is the most stable. As with the MLR, the eleven test subjects all manifested a range of decrease, of which there were two series (fig.1, E and F) in which it completely disappeared. The MLR and SVR of the evoked responses of auditory region of the cortex both showed the inhibiting effect of the qigong state <sup>(8,9)</sup>.

The visual light flash evoked potential (VEP-F) and visual image evoked potential (VEP-P) of twenty-six test subjects was recorded using light flashes and images as stimuli in order to observe the activity in the visual cortex during the qigong state <sup>(10,11)</sup>. The normal VEP-F is formed from a series of polyphase waves (fig. 1, G); the normal VEP-P image is relatively constant, and is expressed by each wave's phase and latent time: N<sub>60</sub> (the negative phase wave with a latent time of 60ms), P<sub>90</sub>, N<sub>140</sub>, P<sub>200</sub>, and N<sub>230</sub>. After the test subjects had entered the qigong state, every component of both the VEP-F and VEP-P suffered a differing degree of inhibition (fig. 1, I, G, and H). It is already known that visual stimulation evoked responses are produced in the cerebral cortex occipital region's primary visual cortex and the secondary visual cortex of the temporal region. The contributing factors of the VEP-P image is now basically clear. The N<sub>60</sub> comes from the afferent nerves at the central depression of the retina and is sent by means of the electrical activity produced in the [stria] of the primary visual cortex. The N<sub>90</sub> uses the electrical activity of the [stria] cuneiform returning to the calcarine sulcus cortex at the rear. Although the forms of the N<sub>140</sub> and P<sub>200</sub> are explained differently, they can basically be recognized as electrical activity formed by vision passing to the cortex via feedback circuits or as a component of mental activity. They are also recognized as being related to the process of handling visual information in the cortex.

Using somatic stimulation, such as stimulating the electric potential activity of the somatic region of the central neural evoked cortex, is called somatic evoked potential (SEP). Normal SEP in the 200ms range can record a series of wave motions of electric potential (fig. 1 I and J) which are named P<sub>1</sub>, N<sub>1</sub>, P<sub>2</sub>, N<sub>3</sub>, P<sub>3</sub>, N<sub>3</sub>, P<sub>4</sub>, and N<sub>4</sub>. Of these, P<sub>1</sub>, N<sub>1</sub>, P<sub>2</sub>, and N<sub>2</sub> are the most stable. N<sub>1</sub> has a latent time of approximately 30ms, is produced by the somatic sense organs' transmission impulses going through the hypothalamus towards the cortex, and is the primary component of the SEP. There are differing explanations of the components behind it. N<sub>2</sub> has a latent time of approximately 30ms. It probably arises from impulses travelling along the relatively low speed type A fibers from the somatic sense organs. The components behind it are generally known to belong to the primary component of the cortical evoked potential. From tests with a series of 21 subjects it was seen in the great majority of them that when entering the qigong state all SEP components exhibited differing degrees of inhibition, which was most pronounced in the N<sub>4</sub> (fig. 1 Ib), but there were also a few subjects who showed differing degrees of increase (fig. 1 Jh).

On the basis of all of the different types of sensor stimulation used above, tests of observation of the state of the cortical mechanisms during the qigong state prove that broad areas of the cortex exhibited major decreases in activity levels and were in various inhibited states. Yet this inhibited state is inhibition while the test subject was conscious. Qigong theory describes it exactly in this manner. When a person is in the qigong state he can "look without seeing, hear without listening"; this is actually the cortex being at various levels, not a state of complete inhibition. This type of inhibited state is completely different

from sleep. According to tests by Elliot <sup>(25)</sup> when a person is in the process of going from waking to deep sleep, at the same time as the EEG changes accompanying sleep were produced, characteristic changes in SVR appeared. When the test subjects went from consciousness into the beginning of stage II, the fluctuations in SVR increased markedly. During stage II and afterwards, the SVR fluctuations could rise to several times the original value and latent times lengthen notably. But changes in the SVR were indeed lower during the qigong state and thereby strongly prove that the qigong state is not sleep. The increase in SVR during sleep may suggest that while the cortex is in a state of extensive inhibition it can maintain increases in the activity of various regions, or that it becomes an "alertness region" during sleep, or that because of the different time phasing of the cortex's state of inhibition it produces abnormal reactions to stimulation from the outside. This fact also explains why, when the cortex is in states of various degrees of inhibition, the distribution of the inhibition is not at all even. The changes in SEP during the qigong state also point out this fact: the changes in the body-sensory region of the cortex during the qigong state were

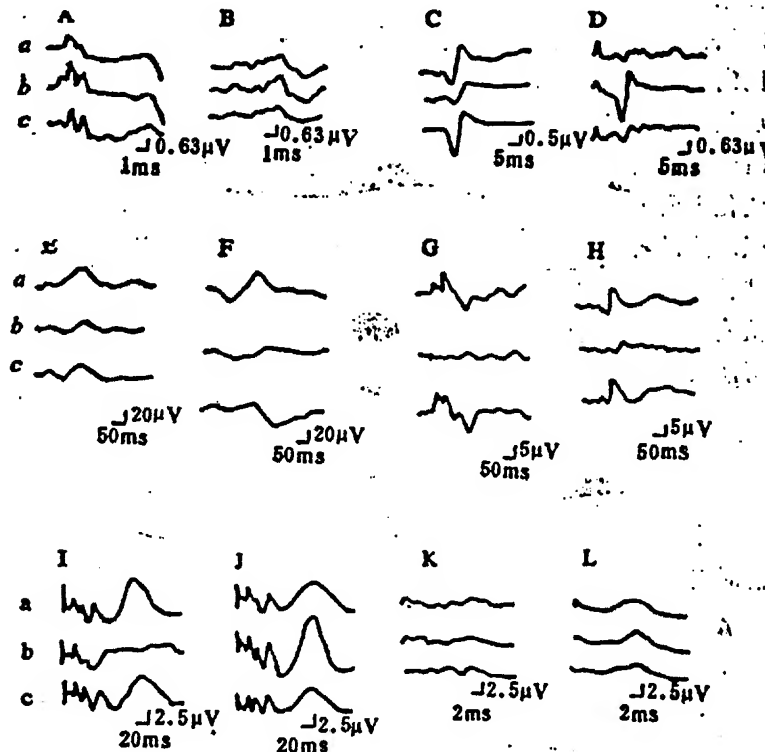


Fig. 1 Evoked Potentials - All types.

a. Pre-qigong. b. Mid-qigong. c. Post-qigong  
 A—EcochG, B—ABR, C—MLR, D—PAP  
 E—SVR, F—SVR, G—VEP-F, H—VEP-P,  
 I—SEP, J—SEP, K—SCEP, L—SCEP

mainly indicated by inhibition, but in certain test subjects they were manifested as increases in activity. This explains that although the cortex mainly has inhibited activity during the qigong state, it also may produce increases in activity under certain circumstances. This fact has significance which cannot be overlooked in explaining how human autonomic mechanisms can accept adjustment by the will and the reasoning behind the phrase "calm the center and it will seek movement".

## TWO — The effects on the auditory peripheral receptors and effectors.

Our experiments utilized the electrocochleogram (EcochG) as an index to observe the effects of the qigong state on the tips of the hearing receptors. We also used the posterior auricular potential (PAP) as the index for the auditory reflex effector organs' auricular muscle activity in exploring the effects of the qigong state on reflex effects. The EcochG is an objective index for understanding the auditory receptors and state of the capabilities of the auditory nerves. The EcochG is composed of the cochlear microphonic potential (CM), synthesized potential (SP), auditory neural movement potential (AP), and other components. Figure 1A includes the N1, N2, and N3 waves of the SP and AP. The PAP is formed from three phases waves named P1, N1, P2, N2, and P3 N3, as shown in figure 1D. The rise in the Ecoch G shows that the auditory receptors entered a facilitory state, that is to say auditory sensitivity rose. Moreover the rise in PAP showed auditory senses entering the inferior colliculus, going through the facial muscle posterior auricular branch to the posterior auricular muscle and stapes, changes in the sensitivity of the middle ear's sound transmission system, are regulated by the feedback-type auditory capabilities. Because the PAP's reflex center is located in the brain stem, increases in the PAP can also be seen as a result of changes in the brain stem.

## THREE — The effects of the qigong state on brain stem evoked response and on the functions of blood vessels in the heart.

It is commonly known that the activities of the internal organs are controlled from the autonomic nervous center; they are not under voluntary control. After qigong has been practised to certain levels, entering the qigong state not only affects the activities of the internal organs but even effects of thought on changing activity levels of internal organs appears. This not only allows lost control of internal organs to be recovered but also makes it possible to produce the effect of mental control over the activities of internal organs which could not appear when not in the qigong state. That is to say it allows involuntary control of the internal organs to be transferred to voluntary control. This is something which cannot be practiced when the body is in a normal functional state. The body being in the supra-normal qigong state possibly allows the nerve centers controlling the autonomic functions to be in a sensitive state, a facilitory state which supplies the conditions for them to receive mental control from the cortex. To prove the existence of this possibility, our research used recordings of the the evoked auditory responses of the brain stem and observed the changes in the functioning of the heart's blood vessels under the qigong state.

Using ultrasound as an evoked stimulation, electrical potential activity was recorded at the "Baihui" acupoint at the top of the skull within 10ms. It was possible to observe multiple levels of change in potential in the transmissions from the medulla oblongata to the hypothalamus cortex. In general it is possible to record seven waves clearly, separately showing the seven levels of activity of the brain stem which are commonly symbolized with the roman numeral I through VII. Wave I is the potential of the auditory nerve functions; wave II is the electrical activity of the cochlear nucleus at the level of the medulla



oblongata; wave III is the caudal pons, relative to the electrical activity of the upper olivary body between the medulla oblongata and the pons; wave IV is the electrical activity of the lateral [horseshoe] nucleus of the pons head end level; wave V is the electrical potential activity of the midbrain quadrigeminal bodies; wave VI is the electrical activity of the medial geniculate body of the hypothalamus; wave VII is the auditory radiations from the hypothalamus to the cortex. Our experiment observed the auditory brain stem evoked responses (ABER) in 28 test subjects during the qigong state. The phenomena observed were basically identical in all of the subjects, differing only in the degree of change. When the subjects entered the qigong state waves I-VI of the ABER all increased by differing degrees (8,14), however the changes in wave VII were more inhibited, just like the changes in the MLR after 10ms, prompting the transition towards cortical inhibition.

The results of this experiment prove that when the body enters the qigong state the autonomic nervous centers located in the brain stem which regulate the activities of the internal organs are placed in an obvious facilitory state. This fact not only supports a type of theory that says "calm the center and it will seek movement" and "calm the center, then seek movement" when the human body is in the qigong state. At the same time it presents a neural biological foundation for explaining the voluntary control by the cerebral cortex over the activities of the internal organs. To prove the effects of the body being in the qigong state on the functions of certain internal organs we selected nine test subjects whose SVR had shown inhibition and whose ABER had clearly exhibited facilitation and determined the changes in the functions of their heart blood vessels during the qigong state. We compared the heart rates of the subjects after they had entered the qigong state and discovered clear alterations in changes in PEP/LVET, PEPI, and other indices. Heart rates slowed, and PEP/LVET and PEPI were reduced, with P values all smaller than 0.05. This group of experiments points out that after the test subjects entered the qigong state, heart rate clearly slowed and the blood-pumping function of the left side of the heart was thus clearly strengthened.

#### FOUR — The effect of the qigong state on the evoked potential of the spinal cord.

When the body is in the qigong state, it may produce the effect of muscle relaxation, or it can produce supra-normal muscular strength; these are well-known phenomena. The basic centers of the regulation of muscle tension are located in the anterior cornu of the spinal cord; motor neurons include  $\alpha$  neurons and  $\gamma$  neurons; the former govern the extrafusal muscles, the latter the intrafusal muscles. Muscle tension and regulation mainly rely on myotatic reflex while at the same time also being controlled by higher centers, in particular the brain stem's descending facilitory system and descending inhibitory system. Thus the activity levels of the anterior cornu of the spinal cord motor neurons are a basic condition for regulating muscle movement and tension. The higher centers use the two mechanisms of facilitation and inhibition to control the activities of the anterior cornu of the spinal cord motor neurons.

This experiment observed and determined the SEP and spinal cord evoked potential (EESG) of twenty test subjects as they entered the qigong state. Normal EESG is poly-phase potential activity and it is divided by the different latent times into P<sub>9</sub>, N<sub>11</sub>, N<sub>12</sub>, and N<sub>14</sub>, of which N<sub>9</sub> and N<sub>11</sub>, and N<sub>18</sub> [sic] appear with the highest frequency. Eight, or 33%, of the twenty test subjects showed increases in EESG, with an average increase of 32%,  $p < 0.001$ ; twelve of them, 66%, exhibited a range of decreases averaging 15%,  $p < 0.001$ . When the body is in the qigong state, it has two functions vis-a-vis the activities of the spinal cord centers. one is facilitation, the other is inhibition. The reason for this



change may be a result produced by facilitation in the brain stem; that is to say when the brain stem reticular formation's descending inhibitory system undergoes changes it is manifested as a drop in EEG, and when the descending facilitatory system undergoes changes it is manifested as an EEG increase. The question of whether the differing EEGs appearing in the different test subjects is due to their different qigong methods or personal individual differences awaits further investigation. Nevertheless, the effect of the qigong state on the EEG obviously has major significance in understanding the reasons why it can result in muscle relaxation or supra-normal muscular strength <sup>(15)</sup>.

#### FIVE — The effects of the qigong state and time on brain electrical emissions.

Experimental research on evoked potential can confirm that when a test subject enters the qigong state definite regions of the cerebral cortex will be in a state of inhibition to a certain degree, as stated above. To further explain the functional state of the cerebral cortex during the qigong state, fourteen qigong masters were again selected for this experiment and the changes in their EEGs were observed before and after entering the state of tranquility. There are already many reports on work in this area <sup>(16,17,18)</sup>, and the results of this experiment have proved these changes once again. This experiment used an EEG with four channels recording occipital and forehead electrodes transmitting to a 7T18(s) signal processor, plotted to form a power spectrum diagram (fig. 2A). The first ten lines are the power spectrum prior to the qigong state, the last ten lines are the spectrum after it. The results of the experiment show when the body is in its normal functional state the entire brain's  $\alpha$  rhythms, using mainly the occipital area, manifests an  $\alpha$  rhythm synchronization from the fixing of the gaze after entering the qigong state, and power increases, most clearly in the forehead. Although the occiput showed increases, they were not equal to those of the forehead. Nevertheless, when compared to the normal state, the phenomena of a deterioration of superior  $\alpha$  rhythms from forehead to occiput appears.

The changes which appear in the EEG at the time of the qigong state <sup>(19,20)</sup> may have profound significance toward explaining the qigong state's neural mechanisms, but at present it is still difficult to explain these changes according to neurobiology's understanding of EEG. However, according to the inhibition phenomena exhibited by the brain evoked potential during the qigong state we can at least infer that a certain link exists between this type of change and the inhibited activity within the cortex. We already know that in EEGs of stage II and stage III sleep there can appear fusiform waves (14Hz) and K-Complex [waves] (8-14Hz) exactly the same as  $\alpha$  rhythms, both of which are EEG changes due to the cortex being in states of inhibition of differing degrees and which accompany them. Our laboratory is now conducting analysis related to EEG topographical brain maps and all types of brain topographical maps of evoked responses to aid in further investigation into this phenomena.

SIX — The effect of emitted qi on a normal person's EEG and changes in EEG during the qigong emission state.

Internal qigong and external qigong are probably different levels of an organism's special functional states. When a qigong master sends out emitted qi it can be seen as the supra-normal functional state of a higher level of internal qigong; and external qi is then the external manifestation of the effects of a supra-normal state. Therefore external qi should possess "biological data" of a material nature and of objective effects. People have had many doubts about the existence of external qi. Being unable to recognize its material na-

ture, they have endowed it with the air of "magic". Thus we are duty-bound to answer whether external qi exists or not, whether or not it can be received by biological organisms, and moreover whether or not it possesses special effects.

Our laboratory has used the method\ of EEG power distribution graph analysis and SEP and SVR determination methods to observe the effects of external qi on the electrical activity of the cerebral cortex; from this we have confirmed external qi's objective physiological effects. The effects on emitted qi on EEGs were observed using six qigong masters capa-

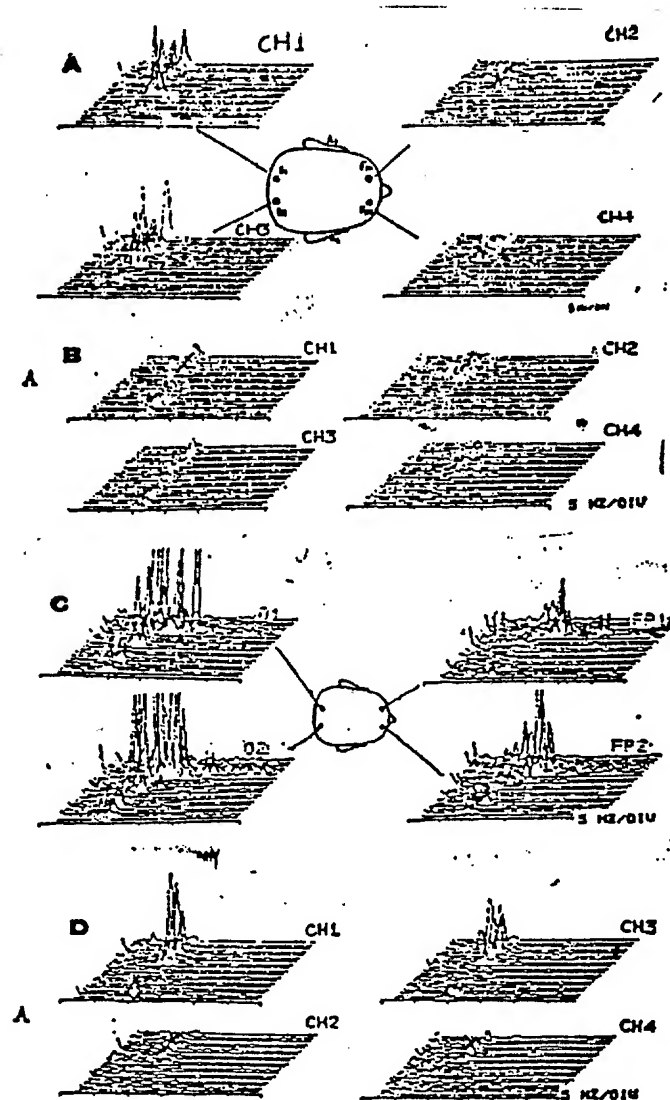


Fig. 2 EEG power spectrum.  
A. Internal qigong state. B. Effect of emitted qi. C. Qi emission state. D. Effect of infrasound. The first 10 lines of each power spectrum is the control state, the last 10 show the changed power spectrum.

ble of emitting external qi and 45 normal test subjects. The results of the experiment showed a fairly clear difference between the group receiving emitted qi and the control group (27 persons), whose average power spectrum from before and after,  $p < 0.01$ , shows a clear difference,  $p < 0.01$  compared with those of the group who received emitted qi. The major change in the EEGs of normal persons after receiving emitted qi in 47 instances was an increase in the forehead electrode  $\alpha$  power spectrum, in 19 cases there was a reverse from the forehead to the occiput, and 23 cases manifested an increase in  $\alpha$  power spectrums in all channels (fig. 2B). Although this fact may confirm that external qi acts as a type of biological signal emitted from a body, and which can be received by an organism and produce biological effects, it is nevertheless difficult to understand, using what we know today, to understand what the influence of emitted qi on EEG is and what its significance is; this presents neuroscience with a new subject for study. Our laboratory is now using experiments on animals to conduct further analysis and investigation on this question.

While researching the influence of emitted qi on EEG, we were simultaneously recording changes in the EEG of the external qi masters while they were emitting qi<sup>(19)</sup>. In measuring six of the external qi masters during the emission of qi we discovered that an overall increase in the EEG power spectrum occurred in the forehead region. There was a particularly strong frequency peak before the state of qi emission from 9~11 Hz shifting to 10~13.5 Hz and a tendency to deviations in  $\beta$  rhythm frequency range (fig. 2C). *T* tests of comparisons of the average frequency range from before and after the state of qi emission show  $p < 0.01$ .

The increase in forehead electrode power spectrums during the state of qi emission and the simultaneous deviations may be due to the thought activity of the qigong masters while emitting qi or they may be related to increases in certain physiological functions during the emission of qi.

#### SEVEN — The influence of emitted qi on the evoked potential in SEP and SVR.

The influence of emitted qi on a normal person's EEG indicates that external qi possesses obvious effects on the central nervous system. To further investigate these effects our laboratory again selected 28 test subjects to use in observations of the effects of emitted qi on SEP and SVR, using 37 other subjects as a control group. In 14 of the test subjects affected by emitted qi, 7 showed an average SVR increase of 35%,  $p < 0.01$ , but another 7 showed a decrease; besides 1 who showed total inhibition, the other 6 had an average decrease of 27.56%,  $p < 0.01$ . The SEP of 14 subjects was influenced. Excepting one who showed a clear rise in amplitude the other 13 all showed a decrease in amplitude, each wave being inhibited by ranges of 27%, 30%, 38%, and 46%,  $p < 0.01$ <sup>(24)</sup>. Although there are certain similarities when the changes in SEP and SVR during the state of qi emission are compared, obvious differences nevertheless exist. During the internal qi state SVR generally decreased, but under the effects of external qi 50% would decrease and the other 50% would increase. Some of the SEPs showed increases under the internal qi state while others decreased, but under the effect of external qi it seemed that all were inhibited. But overall, there may exist certain common neural mechanisms between them.

#### EIGHT — Infrasound and emitted qi.

Based on the results of our experiments, we have forcefully proved that emitted qi possesses a clear effect on the central nervous system and removed doubts as to the material

nature of external qi. But the question of why emitted qi influences the condition of the mechanisms of the central nervous system still awaits an answer. There has been a lot of research on external qi effects from the angle of natural science and engineering which has discovered that emitted qi has magnetic field effects, infrared effects, static electricity fields, and more. Most recently the Ministry of Electronics Industry's Institute of Electro-acoustical Research discovered that when a qigong master is emitting qi infrasonic radiation can be measured which is higher than that of a normal person. The institute also trial-manufactured a bionic qigong instrument which featured an infrasonic component<sup>(22,23)</sup>. In our own probes into the mechanisms of emitted qi effects we used infrasonic generators to conduct a large number of tests, the results of which showed that the biological effects of infrasound are similar to external qi to a certain degree, though they are by no means identical.

Prior to the tests the aforementioned masters of external qigong underwent measurement of the infrasound component of their emitted qi. From the 27 masters, 6 with infrasound frequencies of 9~12.5 Hz and volume levels over 70dB were selected to participate in our experiment. Altogether 34 normal test subjects were used to observe the influence of the infrasound on EEG, SVR, and SEP. There were no control groups.

The 20 normal test subjects' EEG power spectrum from before and after being acted on by the infrasound clearly showed changes, as shown in figure 2D. Investigation of the average power spectrum from before and after being affected by infrasound showed  $p < 0.01$ . The major change was a distinct rise in the power spectrum phase synchronized with the infrasound frequency, which was particularly pronounced in the occipital region. There were 11 subjects on whom the effects were similar to those of emitted qi, exhibiting a reversal from the forehead to the occiput. The influence of the infrasound on SVR and SEP was also similar to that of emitted qi, although it was not totally identical. Of 17 normal subjects the infrasound effect on 12 of them was distinct drop in the SVR range, averaging up to 38.76%,  $p < 0.01$ . The other 5 showed no change,  $p < 0.05$ . Of 13 normal subjects who received infrasound, 9 showed distinct inhibition of N1, though N2 and N3 increased by differing degrees while the other 4 showed no clear changes; this is clearly not the same as the general inhibitory effects of emitted qi.

We can see from the results of the above experiments that both emitted qi and infrasound had distinct effects on the nervous system, though the effects of the two were also distinctly different. We therefore cannot consider infrasound to be the effective component of emitted qi, although we also cannot ignore that there is a certain similarity between their effects. It is reasonable to consider the infrasound may be an important factor in the effective component of emitted qi or that it is may be a carrier wave component carrying other components. For instance, in the experiments on the influence of emitted qi on a normal person's EEG we discovered a startling phenomenon: the peak frequencies of the power spectrum of the subjects' EEGs were phase synchronized with the infrasound frequencies in the qi emitted by the corresponding qigong master. This phenomena phenomena not only confirms the objective effects of emitted qi, but at the same time points up the probability that its influence on electroencephalograms may be produced primarily due to its infrasonic component or resonance produced between the infrasonic vibrations and the neuron circuits. According to the present understanding of EEG emission mechanisms, vibrations from the hypothalamus neuron circuits transiting on the synchronized neurons are the main reason for the production of synchronized electrical potential emitted from the brain. If infrasound can indeed give rise to resonance on the hypothalamus neurons it may be an important clue to further explaining the mechanisms of emitted qi effects. In order to prove whether or not emitted qi and infrasound are able to affect the neuron circuits of the hypo-

thalamus we shifted to using implanted electrodes. In tests on animals we found that the interrelationship between the activities of the hypothalamus neurons and the changes in electric potential of the cortex may be of aid in further explaining the neural mechanisms of the effects of emitted qi and infrasound.

To summarize, our research is merely to observe certain phenomena of the effects of the qigong state and emitted qi from the angle of neurobiology. We are still at the early stage of understanding, taking the first steps into deep probes into the neural mechanisms of the qigong state. From the positive initial results of our experimental research internal qi, external qi, and infrasound effects, as well as the state of qi emission and other conditions, were all accompanied by marked functional changes in the central nervous system. Therefore it is reasonable to propose that the theories and methods of neurological science may be an important path to further revelations of the mysteries of that special functional state of the human body, the qigong state.

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## An Initial Investigation of the Qigong State's Neural Mechanisms Using Evoked Responses as an Index

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Qigong is a method of regulating one's own mind and body. It has been in China for several thousand years, going back to the Spring and Autumn Period [770-476 B.C.]. Owing to its unique curative and regulatory achievements, it has aroused the widespread interest of China's internal and external medicine, physiology, and natural science communities. In today's highly advanced industrial society, qigong possesses practical significance in banishing nervous tension and regulating people's mental and physical health.

Thus spoke the ancients: "Calm the heart and settle the mind; harmonize the qi, and think not on matters; concentrate the mind on the qi." (Sui dynasty: A Treatise Inquiring into the Sources of All Ailments.) Qigong masters of past ages abided by the self-improving qigong practice that "The ears hear nothing, the eyes see nothing, the mind thinks nothing" (Tang dynasty: One Thousand Golden Methods). "That which one needs to improve the body lies in regulating the mind. If the mind is not present, one looks without seeing, hears without listening, and eats without tasting. This is why the meaning of improving the body lies in regulation of the mind" (Warring States Period: The Great Learning). One can see why the interrelationship of "thought" and "qi" and "mind" and "body" during the practice of qigong is one of qigong's core problems. Thus research into the neural systems related to the conscious and devine minds during the practice of qigong was the first subject to bear the brunt of overabundant interest.

Chinese and foreign scholars, particularly those in China, have done many reports concerning qiong research, but research involving the essential question of qigong mechanisms is still little seen. Due to the limitations of research methods, research in the area of neural systems in particular is often simply observing changes in the brain's electrical potential during the qigong state. And research into the related distinctive changes in the cortex, the lower centers of the cortex, and the transmitting nerves and receptors during the qigong state is even more rarely seen. This paper is based on the one of the signs of the qigong state of "listening without hearing" in order to "strengthen the body by regulating the mind". We used the middle latent response time (MLR) of the auditory evoked cortex, auditory brain stem evoked response (ABR), Electrocochleagram (EcochG), and the posterior auricular potential (PAP), divided into the three different levels of cortex, brain stem, and periphery, to conduct observation and analysis of changes in the neural mechanisms of qigong masters before, during and after doing qigong.

### ONE — Methods

#### 1. The subjects and test procedures.

The experiment used 38 qigong masters, 32 males and 6 females, ranging in age from 21 to 50. Their experience practicing qigong ranged from 2 to 20 years. The subjects sat in a shielded room in which a quiet environment was maintained. Each experiment measured a single test item, and each test subject participated in the same test item only once. To begin, a series of two determinations were made of their electric potentials under normal conditions to be used as controls. Then they were told to do qigong and enter the state of tranquility and after 10 minutes, measurements were taken of the cortex's long latent time responses. The inhibition of this potential was used as the indicator of entry into the qigong state <sup>(1)</sup>. Two successive measurements were made during the qigong state. Finally, they were called to recover from the qigong state and after 30 minutes another two meas-



urements, of post-qigong potential, were made.

## 2. Electrodes and Instruments.

Except for the cotton ball recording electrodes of the EcochG and PAP, all the others used 0.6cm silver disc electrodes; the resistance of the electrode contacts was less than 5~10k $\Omega$ . During the same experiment, similar electrode positions were maintained for each test subject. The stimulation was supplied through stereo earphones using short waves with a wave width of 0.1ms, a strength of 40dB, and a frequency varying with each item of the test. The experiment used the Japanese Neuropack II MEB-5100 electro-optical evoked response recording system.

Parameters of the electrode positions and instruments in each item of the experiment.

MLR: the recording electrodes were placed on the "Baihui" accupoint, with reference electrodes on the right nipple, and center of the forehead. The instruments' band pass filter was 5Hz~1kHz, with an analysis time of 50ms, and a superposition of , frequency 5Hz, and strength of 55~75dB.

ABR: electrode positions as for MLR. Band pass filter of 100Hz~1kHz, analysis time of 10ms, superposition of 1024~2048, and a frequency of 10Hz.

EcochG: the recording electrodes were placed in the outer ear canal touching the ear drum, with reference electrodes on the nipple on the same side and in the center of the forehead. The band pass filter was 2Hz~3kHz, analysis time 10ms, superposition of 1024, and frequency 10Hz.

PAP: analysis time was 50ms; the rest were as for the EcochG, except the electrode did not need to touch the ear drum.

## 3. Wave measurement, data processing, and statistical methods.

The latent times of the peak latent times of all of the curves of changes in potential were indicated by the time from the beginning of stimulation to a vertical line joining the baseline with the highest point of each wave peak. For MLR and EcochG, the vertical height from the base to the amplitude peak <sup>(2,3)</sup>; for the ABR and PAP, the vertical height from peak to peak; for ABR, the height of type IV and type V waves and the height from the trough preceeding type IV waves to the top of the wave <sup>(4,5)</sup>. In each item of the experiment, every change was measured as two lines and their average value was taken for calculations. All data was input for computer processing. First a self-comparison *t* test was conducted before, during, and after qigong. Then for each test item we found the percentage change of each component during the qigong state and used them to conduct investigations of the percentage changes between adjacent waves.

## TWO — Results

### 1. Changes in MLR during the qigong state.

Measurements were determined for a total of 11 subjects. Under normal conditions, 3~5 waves will usually appear within 50ms after auditory stimulation. Of these waves, the ones with the highest rate of appearance are the three positive-negative-positive waves near 10.92 $\pm$ 0.397ms, 14.38 $\pm$ 0.45ms, and 20.12 $\pm$ 0.67ms (fig. 1, nr. 1). In accordance with their respective phases and order of appearance they are named Po, Na, Pa <sup>(2,6)</sup>. Voltage was about 0.035~0.33 $\mu$ V (fig.2). During the qigong state all of the waves suffered differing degrees of inhibition. In comparison with their pre-qigong state, Na's amplitude was suppressed from 0.33 $\pm$ 0.06 $\mu$ V to 0.09 $\pm$ 0.02 $\mu$ V (*p*<0.01), Pa's from 0.24 $\pm$ 0.06 $\mu$ V to



$0.11 \pm 0.03 \mu V$  ( $p < 0.05$ ), and that of  $P_o$  from  $0.04 \mu V \pm 0.01$  to  $0.02 \pm 0.01 \mu V$  (fig. 1, nr. 2, 2). A comparison between the percentages of inhibition suffered by the adjacent waves shows  $p < 0.001$  between  $P_o$  and  $N_a$ , and  $p > 0.05$  between  $N_a$  and  $P_a$  (chart 1). The voltages of all of the waves returned to about pre-qigong levels about 30 minutes after the end of the qigong state. (fig. 1, nr. 3, 2).

## 2. Changes in ABR during the qigong state.

Measurements were determined for 21 test subjects, 17 male and 4 female. 10ms after

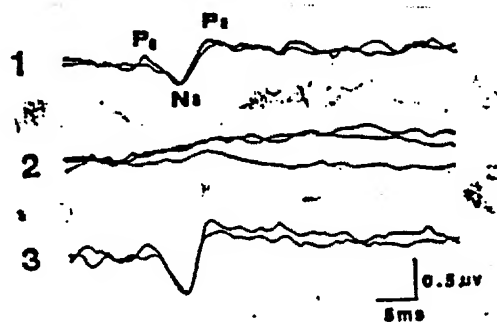


Fig. 1 Effects of qigong state on MLR.  
Nr. 7; Wu (first name withheld), male, age 20.  
1. Normal state.  
2. Qigong state.  
3. 30 min. after cessation of qigong.

auditory stimulation 6~7 positive waves appeared (fig. 3, A). These are separately named wave I, wave II, wave III, wave IV, wave V, wave VI, and wave VII (4,7). All of the waves appeared between  $1.91 \pm 0.04$  ms and  $9.08 \pm 0.07$  ms, with a voltage of about  $0.11 \pm 0.02 \mu V$  to  $0.5 \pm 0.05 \mu V$  (fig. 4), with waves IV and V usually being composite waves. During the qigong state the wave amplitude of the great majority increased (fig. 3, B). The increases in comparison with the control measurements of each subject prior to beginning qigong to enter the qigong state were (see fig. 4):

wave I	from $0.11 \pm 0.02 \mu V$ to $0.17 \pm 0.03 \mu V$ ( $p < 0.05$ )
wave II	from $0.18 \pm 0.02 \mu V$ to $0.29 \pm 0.04 \mu V$ ( $p < 0.001$ )
wave III	from $0.22 \pm 0.03 \mu V$ to $0.34 \pm 0.06 \mu V$ ( $p < 0.01$ )
wave IV	from $0.34 \pm 0.04 \mu V$ to $0.60 \pm 0.05 \mu V$ ( $p < 0.001$ )
wave V	from $0.5 \pm 0.05 \mu V$ to $0.85 \pm 0.08 \mu V$ ( $p < 0.001$ )
wave VI	from $0.17 \pm 0.04 \mu V$ to $0.18 \pm 0.04 \mu V$
wave VII	decreased from $0.21 \pm 0.04 \mu V$ to $0.19 \pm 0.04 \mu V$

Thirty minutes after the qigong state, each wave had returned exactly to the pre-qigong levels.

## 3. Changes in EcochG during the qigong state.

Measurements were determined for a total of 13 subjects. Within 10ms after auditory stimulation 3~4 distinct negative waves appeared (fig. 5, nr. 1). These were near  $1.38 \pm 0.06$  ms,  $1.91 \pm 0.08$  ms,  $2.95 \pm 0.08$  ms, and  $4.11 \pm 0.09$  ms and named SP, N1, N2, and N3 respectively (8). Voltages were within the range of  $0.16 \pm 0.04 \mu V$  to  $0.8 \pm 0.09 \mu V$  (fig.

6) The amplitude of each of the waves rose in the qigong state (fig. 5, nr.2). When compared to each subjects pre-qigong control values, SP rose from  $0.24 \pm 0.03 \mu V$  to  $0.35 \pm 0.04 \mu V$  ( $p < 0.01$ ), N1 from  $0.8 \pm 0.09 \mu V$  to  $1.17 \pm 0.1 \mu V$  ( $p \leq 0.001$ ), N2 from 0.29

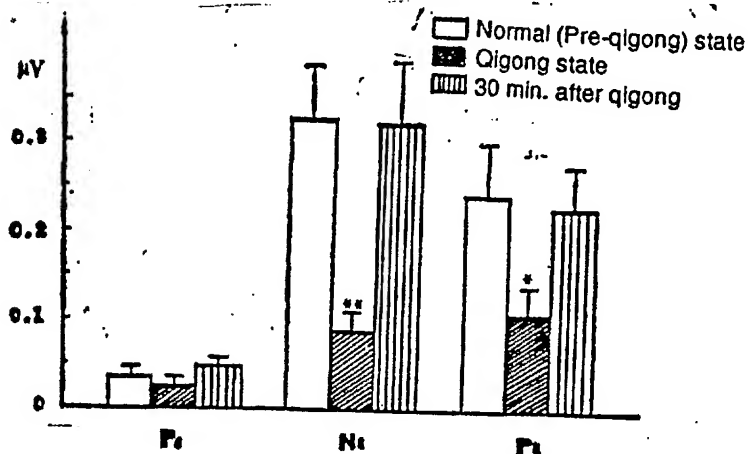


Fig. 2 Comparison of each component of MLR from before, during, and after the qigong state. \* $p < 0.05$ , \*\* $p < 0.01$  (compared with normal state).

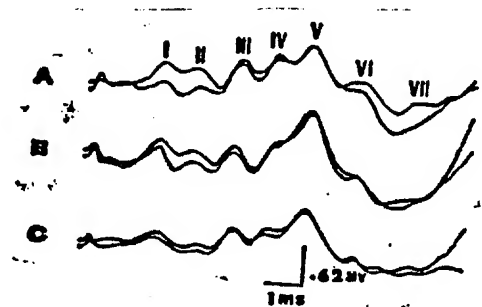


Fig. 3 Effects of qigong state on ABR. Nr. 11; Liu (first name withheld), female, age 22. A. Normal state. B. Qigong state. C. 30 min. after cessation of qigong.

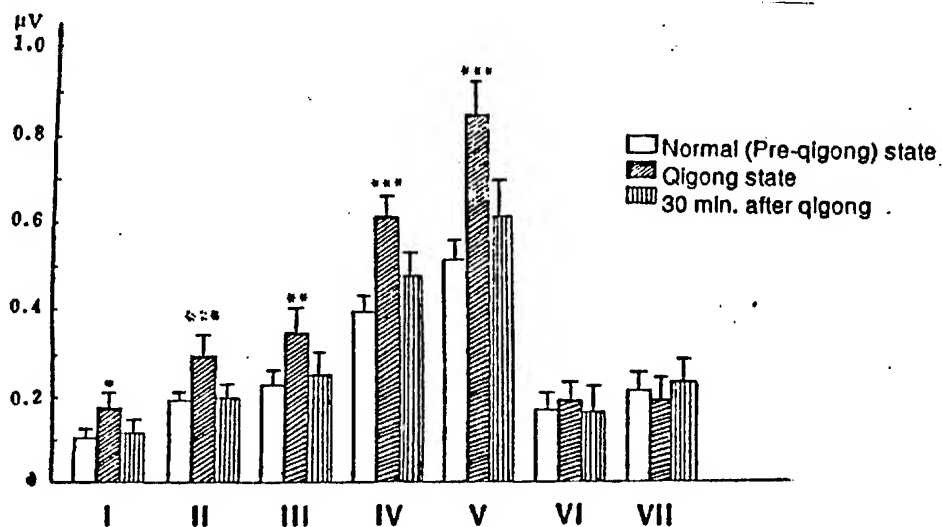


Fig. 4 Comparison of each component of ABR from before, during, and after the qigong state. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$  (compared with normal state).

$\pm 0.04\mu\text{V}$  to  $0.39\pm 0.04\mu\text{V}$  ( $p<0.05$ ), and N3 from  $0.16\pm 0.04\mu\text{V}$  to  $0.24\pm 0.04\mu\text{V}$  ( $p<0.05$ ). Comparing the percentage change in the two adjacent waves during the qigong state showed little difference between SP and N1 and N1 and N2, but there was a sharp dif-

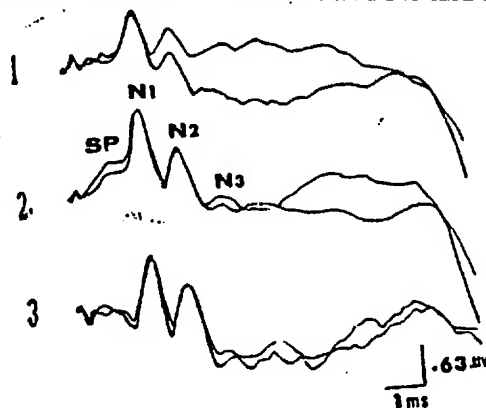


Fig. 5 Effects of qigong state on EcochG.  
Nr. 6; Han (first name withheld), male, age 40.  
1. Normal state.  
2. Qigong state.  
3. 30 min. after cessation of qigong.

ference between N2 and N3 ( $p<0.001$ ), as shown in the charts. The voltages of most of the qigong masters returned to pre-qigong levels 30 minutes after leaving the qigong state. But during the experiments the voltages of one qigong master were seen to recover quite slowly; recovery began after 30 minutes and had basically returned to normal after 50 minutes, only returning fully to normal after 1 hour.

#### 4. Changes in PAP during the qigong state.

Measurements were determined for 11 test subjects. Within 50ms after auditory stimulation, three positively phased and two negatively phased waves appeared, which were named P1, N1, P2, N2, R3 [sic]<sup>(9)</sup>. Of these, N1, P2, and N2 had the highest rate of appearance (100%) and were stable (fig. 7a). Their normal, pre-qigong voltages were between  $0.23\pm 0.06\mu\text{V}$  and  $1.28\pm 0.3\mu\text{V}$  (fig. 8), with the latent times for the three near  $11.39\pm 0.38\text{ms}$ ,  $14.98\pm 0.32\text{ms}$ , and  $19.29\pm 0.49\text{ms}$ . In the qigong state, the voltage of all of the waves increased (fig. 7, b), N1 rising from  $0.23\pm 0.06\mu\text{V}$  to  $0.33\pm 0.05\mu\text{V}$  ( $p<0.05$ ), P2 from  $0.88\pm 0.19\mu\text{V}$  to  $3.64\pm 0.62\mu\text{V}$  ( $p<0.001$ ), and N2 from  $1.28\pm 0.3\mu\text{V}$  to  $4.13\pm 0.95\mu\text{V}$  ( $p<0.01$ ), as seen in fig. 8. Comparison of the percentage change in the adjacent waves during the qigong state showed a striking difference between N1 and P2, as well as a difference between P2 and N2 (see chart). The voltage of each wave recovered to normal levels 30 minutes after having been in the qigong state, with no outstanding differences compared with the pre-qigong conditions.

### THREE — Discussion.

Qigong is undoubtedly different from sleep (10,11). But in investigating the activity of neural mechanisms in the qigong state, most articles sweepingly call it "the cerebral cortex maintained in an inhibited state". Until now no report has comprehensively and systematically conducted composite research into its mechanisms. This article observed the functional changes during the qigong state in the central nervous system from the cerebral

cortex, brain stem, and three peripheral levels; it also made an initial probe into the laws and physiological significance of these changes.

1. During the qigong state the middle latent time of the cerebral auditory cortex enters an inhibited state.

It is generally known that auditory evoked response is divided according to latent times into three components: early, middle, and late. That within 10ms is early, including the ABR and EcochG; within 50ms middle, including MLR and PAP; and larger than 50ms be-

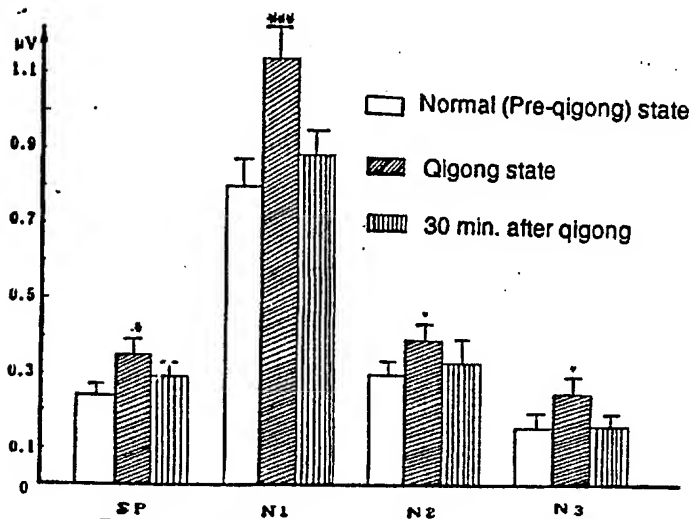


Fig. 6 Comparison of each component of EcochG from before, during, and after the qigong state. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$  (compared with normal state).

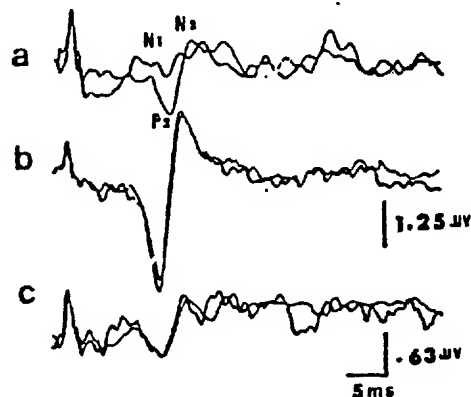


Fig. 7 Effects of qigong state on PAP. Nr. 1; LI (first name withheld), male, age 26. a. Normal state. b. Qigong state. c. 30 min. after cessation of qigong state.

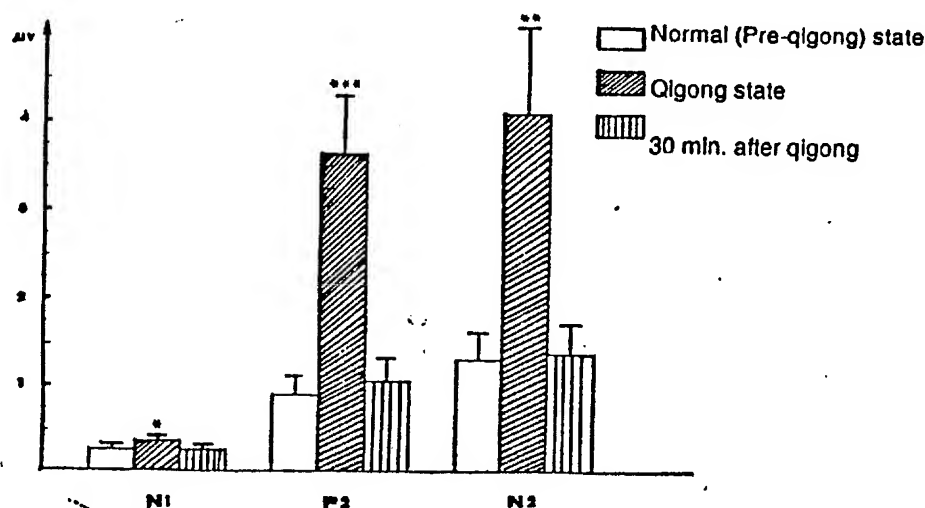


Fig. 8 Comparison of each component of PAP from before, during, and after the qigong state. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$  (compared with normal state).

ing late (5,9,12-14). The middle and late components mostly reflect activity in the auditory cortex, excluding the muscular primary responses of PAP. We utilized the slow latent response (SLR) to carry out thorough observation and analysis of the cortical components within 500ms, while at the same time also using the ABR to observe brain stem activity. In the qigong state SLR is inhibited while ABR changes (1). On this foundation, this paper then did further research on the MLR, which lies between the SLR and ABR, and is the common boundary of the inhibition and change of the cortical components. Picton (1974) considers that the source of MLR is in the thalamus, primarily issuing from the auditory cortex and secondary auditory cortex. The sources of Po and Na may lie in the medial geniculate body and [multi-sensory] nucleus of the thalamus, and that of Pa may be in the temporal lobe and frontal lobe's secondary auditory cortex (5). Ozdamar (1982) considers the source of MLR to be in the auditory cortex or secondary cortex, perhaps coming from the auditory radiation of the thalamus, of which the source of Pa may lie in the temporal lobe of both sides (15). Davis (1976) reported that MLR comes from region I of the auditory cortex. Experimental results show that Na and Pa are both inhibited during the qigong state. This suggests that the auditory primary cortex, the secondary accessory auditory cortex, and the auditory radiation below the cortex and on the level of the thalamus all may be in an inhibited condition. This happens to agree with the changes in the 230ms component of the visual evoked response (see "The Effects of the Qigong State on Visual Image Evoked Response.") and in the type VII wave of the brain stem evoked response during the qigong state. It can be seen from the graphs that there is a clear discrepancy between the degree of inhibition of Po and Na during the qigong state, while there is no difference between Na and Pa. This explains that the effect of the qigong state is not the same on all three waves, thus allowing them to be at two levels of inhibition, with Na and Pa being inhibited to a greater degree than Po. This indicates that the degree of inhibition from the qigong state is greater on the supertemporal lobe (region I of the auditory cortex) and multi-sensory nucleus of the thalamus than on the medial geniculate body of the interbrain.

From the large amount of work we have done it is not hard to see that in the qigong state the cerebrum's body-sensory cortex, auditory cortex, and visual cortex are all inhibited. There may be two sides to the physiological effects of this broad inhibition of the cerebral cortex:

One is purifying or "defibrillation", similar to defibrillation in the heart. "The temples and mind converge into one, concentrating in one place" (Qing dynasty; The Shen Family Elder Students). When a qigong master enters the state of tranquility his thoughts observe the "Red Fields" (the pubic region) and in the cortex only the point of the cortex related to the "Red Fields" is stimulated. This point of stimulation allows the rest of the cortex to fall into an inhibited condition. Temporarily using one point of excitation to control the activities of the entire cortex in this manner leads cortical activity to tend towards synchronization and orderliness. This is beneficial in eliminating all types of interference, in regulating neural disorder, and in lowering sensitivity to stimulation of a negative nature from the outside world. This may be just where lies the special effectiveness which qigong possesses to harmonizing the mind-body (mental thoughts and physical body) balance.

Two is assimilation and the accumulation of capability. When one does qigong and enters tranquility, "accumulating spirit to produce qi, accumulating qi to produce perfection...; practice perfection to change to qi; practice qi to change into spirit." (Qing dynasty; Selecting Without Medicines). This is to say that in the qigong state the cerebral cortex is in a condition of protective inhibition. The body relaxes, the thoughts calm, the spirit is directed inward, the mind and qi fuse, the cortex dissimilates and metabolic processes slow

down, increasing the dissimulation from metabolic processes. Some call this process directional metabolism, but Gellhorn (1972) and Dowidson (1976) call it nutritional response (16). This may be the reason why qigong can eliminate tension, banish fatigue, ensure bodily energy and vigor, and extend long life.

2. During the qigong state the brain stem is in different degrees of facilitory states.

The brain stem is composed of the midbrain, pons, and medulla oblongata. It is the center for sustains important bodily life functions. The cerebrum, cerebellum, and all parts of the body are able to intercommunicate through it so as to regulate the functions of the entire body. There have been early reports on work using auditory evoked brain stem response (ABR) to understand pathological changes in the cerebrum and brain stem (17-19).

But work using ABR to observe brain stem activity began only recently (1) and is mostly observation to determine the nature of the question. This paper is to conduct a quantitative analysis of the changes in each wave in the brain stem during the qigong state.

Within 10ms after audio stimulation the brain stem's auditory evoked response appears as 5 to 7 waves, whose source is now quite clear (1,2). The source of wave I is in the auditory nerves, that of wave II in the cochlear nucleus, wave III in the upper olivary body, wave IV in the lateral [horseshoe system] nucleus, wave V in the inferior colliculus of the quadrigeminal bodies, wave VI in the medial geniculate body, and wave VII in the auditory radiation. The different waves represent different centers, and the different centers are located at different levels of the brain stem. The cochlear nucleus, located in the medulla oblongata, can indicate brain stem activity at the level of the medulla oblongata; the olivary body is located on the pons medulla oblongata side; the lateral [horseshoe system] in the pons; the inferior colliculus of the quadrigeminal bodies in the midbrain; the medial geniculate body in the thalamus; and the auditory radiation is emitted from the thalamus to the auditory cortex. The size of the seven waves of brain stem evoked responses not only reflects size of the excitation of the corresponding center in the auditory circuits, but also reflects the activity level of the surrounding organizations of each center (20-22).

From the results of this test it can be seen that the changes in auditory brain stem response shown at different levels are not alike. Facilitation is manifested from the midbrain to the medulla oblongata, of which the pons level (lateral [horseshoe system] nucleus, wave IV) facilitation is the most marked (138.42%); the midbrain level (inferior colliculus of the quadrigeminal bodies, wave V) facilitation is the next clearest (91.93%). Continuing down in order of the amount of facilitation we have the pons-medulla oblongata boundary level, the medulla oblongata level, and the outer peripherals (wave II change of 71.35%, wave III of 67.59%, and wave I 63.14% respectively). Although the thalamus (medial geniculate body, wave VI facilitation of 41.65%) shows facilitation phenomena, there are no statistics to study their significance. Very interesting is that not only does the auditory radiation (wave VII, 9.5%) near the cortex show no facilitation at all, but on the contrary it becomes inhibited. Comparisons of adjacent waves support the conclusions above. The degrees of facilitation in the brain stem under the qigong state are not identical; the pons is one level, the midbrain is another, and so are the medulla oblongata and peripherals and the thalamus. Auditory radiations, on the other hand, undergo inhibition. In general, in the qigong state the brain stem seems to have this tendency: going from auditory cortex to brain stem to periphery there is inhibition - strong changes - less strong changes respectively.

This phenomena may be related to a lowering of the inhibitory ability of the lower centers after the cerebral cortex has been inhibited by the qigong state. This tallies with and gives positive guidance to understand the theory put forward by the Russian physiologist Pavlov in the early 20th century that when the cerebral cortex is in a state of inhibition this has the effect of facilitating the neural centers under the cortex.

The facilitation in the brain stem is significant, owing the fact that the autonomic nerve centers regulating the internal organs are located there. Therefore facilitation in the brain stem must create increased activity in the internal organs, thus providing an experimental basis for the qigong state "internal organ movements" theory. Whether the facilitation effects of the brain stem under the qigong state are active or passive, and why the degrees of facilitation are not the same at different levels of the brain stem, both await further research. Whether the lowered condition of facilitation of the thalamus in the qigong state is after all a diffusion of this facilitation to lower locations or a result of the upper inhibition and lower facilitation cancelling each other out, also awaits further clarification.

3. During the qigong state auditory peripheral sensory organ excitation is increased.

Most of the reports concerned with the activity of peripheral nerves and sensory organs under the qigong state have used skin potentials and such. But inner ear potentials, middle auricular muscle primary activity, posterior auricular potential, and the activity of other excellent sensory and effector organs have been little reported on. By observing primary responses of inner ear potential and auricular muscles it is possible on the one hand understand the activity of peripheral sense organs in the state of tranquility, while on the other hand to distinguish whether or not changes in qigong state central auditory evoked response are caused by the inner ear.

The EcochG is an objective method of investigation, as it is not dependant on the influence of the test subject's behavior and thus investigation results possess reproducibility and precision. The electrodes can be positioned near the tips of the hearing structures and the responses present a strictly one-sided nature; for this reason there is no need for shielding against sources of sound or electrical potential and the responses are quite clear and easy to locate. Because the EcochG is not influenced by thought activity, tranquilizers, or total anaesthesia it can be considered the ideal indicator of functional changes in auditory sensors (peripheral sensors) and auditory nerves (peripheral nerves) in the qigong state.

The EcochG is formed from cochlear microphonic potential (CM), synthesized potential (SP), and auditory neural activity potential (AP). The former two are caused by activity of the hair cells and basilar membrane, while the latter is caused by the auditory nerves. Therefore the height of the potential of each usually represents the activity level of the corresponding structure.

SP is the changes in DC potential produced by movements of the basilar membrane under auditory stimulation, recorded with SP used for when there is no vibration in the membrane, —SP used for when the membrane stretches toward the cochlear tube, and +SP uses for when the membrane stretches toward the eardrum; and also in measurements, —SP can be used in for when there is a large degree of vibration of the membrane, and +SP for a small degree of vibration; increases in direct current potential within the cochlear tube (Endocochlear DC potential) can be written as —SP and decreases as +SP. During stimulation of the olivary cochlear bundle, —SP decreases and +SP increases; Wei Baoling considers —SP to have the effect of excitation and +SP an inhibitory effect (23).

AP is composed of N<sub>1</sub>, N<sub>2</sub>, and N<sub>3</sub>. N<sub>1</sub> has the greatest number of synchronized neurons and the highest degree of synchronization, thus it has the largest electrical potential and highest oscillation. N<sub>2</sub> and N<sub>3</sub> have a smaller amount of synchronized response neurons and less synchronicity. Their components include long latent time auditory nerve fiber discharges and auditory nerve fiber repeat discharges. They may also include elimination of positive potential from the cochlear nucleus and upper olivary body, and therefore their potential is progressively lowered.

From the results of the experiments we were able to see that in the state of tranquility the EcochG wave group manifested differing degrees of increase. Compared with before the

start of qigong, N1 potential changed  $51.3\mu V\%$  ( $p < 0.001$ ), N2 changed  $50.7\%$  ( $p < 0.05$ ); N3 changed  $110.74\%$  ( $p < 0.05$ ), and SP changed  $51.93\%$  ( $p < 0.01$ ). CM, however, was rather difficult to observe as it suffered from the forward and reverse phases alternately cancelling each other out. These changes are identical to the increase in hearing and decrease in hearing state when in the state of tranquility as reported by Clements (1980). During the qigong state —SP rises and N1, N2, and N3 are increased; this may explain how the qigong state can heighten the excitability of the inner ear hair cells and the basilar membrane while increasing the number of synchronously discharged neurons and their synchronicity. But after 30 minutes of recovery from cessation of the qigong, the SP in figure 5, nr. 3, had changed from SP to +SP, which explains the low EP and state of inhibition at this time after the cochlea had been excited.

We discovered from the above experimental ABR and EcochG results that brain stem waves I and II and N1 and N2 of cochlea potential explain that peripheral excitation has risen and that everything has changed from the brain stem to the peripherals. So are the changes in the ABR arise from the EcochG? Or did the changes in the ABR create the EcochG changes? Looking at it only from the results of this experiment it would seem that the latter is more probable, but this too awaits further investigation and study.

Changes in PAP also increased during the qigong state. Posterior auricular potential belongs to the category of muscular electricity; it is started by audio reflex. Sound acts upon the hair cells and is carried on the auditory nerves to the cochlear posterior nucleus, upper olivary body, lateral [horseshoe system], inferior colliculus, and then to the facial nerve nucleus; it passes through the facial nerves and posterior auricular branch to arrive at the posterior auricular muscle <sup>(24)</sup>. Because the center for this reflex is in the pons, it belongs to the centers below the cortex. For this reason this process is in no way under conscious control <sup>(25)</sup>. Methods for recording this response are simple, as the amplitude of the response is large and wave forms are clear. It is another ideal indicator for understanding the activities of the peripheral muscles and nerves and the activities as the path of the reflex moves along these structures. Since a portion of the nerves (facial nerves) which this reflex is transmitted through goes directly to the muscles of the stapes in the middle ear, from it we can indirectly understand the activities of the inner ear muscles in the qigong state. Looking at our experimental results (fig.s 7b, 8) from the qigong state, we see that of the increases in posterior auricular potential, that of P2 was the most distinct, followed by N2; that of N1 was also significant. First of all, this explains the rise in excitation and increase in potential of the posterior auricular muscles and face and other bones and muscles during the qigong state. This is the embodiment of the qigong principle "The form is relaxed, the mind is tight" <sup>(26)</sup>; outer tranquility is the method, inner tranquility is the goal <sup>(27)</sup>. Although in the qigong state the face and all the muscles of the body are apparently and subjectively relaxed <sup>(26)</sup>, they are in fact in a kind of condition of alert. Secondly, due to the fact that the route this reflex follows is similar to ABR, in the qigong state the response increases and the latent time shortens. This not only tests and verifies the qigong state changes in ABR, but also in itself may be created as a result of facilitation in the brain stem. Thirdly, the sensors for this reflex are in the inner ear and after they pass this reflex they return to the feedback loop of the middle ear muscle structures. Therefore the posterior auricular potential increases in the qigong state, which indirectly explains why the degree of tension in the middle ear increases at the same time. When the degree of middle ear muscle tension increases the stapes is pulled, which results in an increase in sound resistance and weakens the volume of the sound reaching the inner ear, producing a protective negative feedback effect and necessarily leading to a drop in inner ear activity. Actually, the qigong



state allows the inner ear to be more excitable than in its normal state. This very possibly is a result created by changes in the upper brain stem, and also explains that the qigong state brain stem facilitation phenomena is definitely not created by the inner ear but points out that it is a result of changes in upper initiative activities.

Percentage Voltage Changes & Difference in Changes Between Waves					Units: $\mu V$
Wave Name	Pre-qigong	Qigong State	Post-qigong	Qigong State %age change	Difference in %age change of each wave
$P_o$	$0.04 \pm 0.01$	$0.02 \pm 0.01$	$0.05 \pm 0.01$	$31.43 \pm 17.71\%$	$p < 0.001$
$N_o$	$0.33 \pm 0.06$	$0.09 \pm 0.02^{**}$	$0.32 \pm 0.07$	$72.09 \pm 5.78\%$	$p > 0.05$
$P_o$	$0.24 \pm 0.06$	$0.11 \pm 0.03^*$	$0.23 \pm 0.05$	$54.73 \pm 9.89\%$	
$I$	$0.11 \pm 0.02$	$0.17 \pm 0.03^*$	$0.11 \pm 0.03$	$63.14 \pm 27.98\%$	$p > 0.05$
$II$	$0.18 \pm 0.02$	$0.29 \pm 0.04^{***}$	$0.19 \pm 0.03$	$71.35 \pm 20.89\%$	$p > 0.05$
$III$	$0.22 \pm 0.03$	$0.34 \pm 0.06^{**}$	$0.25 \pm 0.05$	$67.59 \pm 19.94\%$	$p < 0.001$
$IV$	$0.34 \pm 0.04$	$0.60 \pm 0.05^{***}$	$0.48 \pm 0.07$	$138.42 \pm 58.27\%$	$p < 0.001$
$V$	$0.60 \pm 0.05$	$0.85 \pm 0.08^{***}$	$0.61 \pm 0.01$	$91.93 \pm 24.63\%$	$p < 0.001$
$VI$	$0.17 \pm 0.04$	$0.18 \pm 0.04$	$0.16 \pm 0.06$	$41.65 \pm 26.19\%$	$p < 0.001$
$VII$	$0.21 \pm 0.04$	$0.19 \pm 0.04$	$0.23 \pm 0.05$	$-4.47 \pm 12.62$	
$SP$	$0.24 \pm 0.03$	$0.36 \pm 0.04^{**}$	$0.29 \pm 0.04$	$51.93 \pm 12.93\%$	$p > 0.05$
$N_1$	$0.8 \pm 0.09$	$1.17 \pm 0.1^{***}$	$0.87 \pm 0.09$	$61.3 \pm 4.68\%$	$p > 0.05$
$N_1$	$0.29 \pm 0.04$	$0.39 \pm 0.04^*$	$0.33 \pm 0.06$	$60.7 \pm 19.44\%$	$p < 0.001$
$N_o$	$0.16 \pm 0.04$	$0.24 \pm 0.04^*$	$0.16 \pm 0.03$	$110.74 \pm 33.19\%$	
$N_1$	$0.23 \pm 0.06$	$0.33 \pm 0.05^*$	$0.23 \pm 0.05$	$43.72 \pm 33.96\%$	$p < 0.001$
$P_1$	$0.88 \pm 0.18$	$3.64 \pm 0.62^{***}$	$1.03 \pm 0.25$	$313.86 \pm 73.28\%$	$p < 0.05$
$N_1$	$1.28 \pm 0.3$	$4.13 \pm 0.95^{**}$	$1.34 \pm 0.34$	$223.16 \pm 78.23\%$	

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$  (compared with normal state).

### Summary in Brief

This experiment observed the influence of the qigong state on the MLR (n = 11), ABR (n = 21), EcochG (n = 13), and PAP (n = 11) of 38 people in the qigong state 56 man/times. The neural mechanisms of qigong were probed at the three levels of the cortex, the brain stem, and the peripheral senses. The test results indicate the when a qigong master enters the state of tranquility, the auditory cortex MLR and ABR wave VII are inhibited; waves I ~ VI of the ABR are facilitated; and EcochG and PAP potentials increase. The relative difference between each of these items before and during the qigong state are outstanding. The above results point out when qigong is done and tranquility entered, the cerebral cortex may be in an inhibited condition, the rest of the brain in a state of facilitation, and the excitation of the peripheral nerves and organs tends to rise. This provides a basis for further explaining the mechanisms in proving the theory that in the qigong state "the cerebrum calms and the inner organs move", and provides an objective indicator of when qigong enters tranquility.

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# The Evoked Electrospinograph and Somatosensory Evoked Potential Changes in the Qigong State

PENG Xueyan and LIU Guolong

The essence of qigong has been expounded by Confucians of China's Warring States period (475-221 B.C.), physicians, Taoists and martial arts experts. The terminology associated with qigong and its related concepts include *tuna* (qi discharge), *daoyin* (nerve meridians), *xingqi* (the qi of movement), *liandan* (concocting medicines), *ligong* (rendering meritorious service), *jinggong* (the gong, or skill of tranquility), *dinggong* (the constant gong), *xinggong* (sexual gong), *neigong* (internal gong), *xiudao* (religious self-cultivation), *zuochan* (meditation), *neiyanggong* (the gong of internal cultivation), and *yangshenggong* (the gong of fostering life). Xu Xun, a Jin Dynasty (265-420 A.D.) Taoist priest who was the first to make use of the word qigong, referred to the term *qigong chanwei* ("the meditative subtlety of qigong") in his work *Jingming Zongjiao Lu* ("Record of the Jingming Religion"). To date, this is the earliest documented use of the term qigong. In medical literature, the earliest mention of the concepts relating to qigong may be found in the *Shanggu Tian Zhen Lun* (Essays on Ancient Wisdom) of the classic *Suwen* (Basic Queries"). Examples of such passages include: "Clear your mind and the essence will follow, concentrate and turn inward, and assurance of no illness will follow," and "In ancient times there was a wiseman, who could handle anything in the universe, he could control yin and yang, he breathed the essence of qi, he could independently concentrate his mind, and his who musculature became one." About that time, the *Qigu Shiqi Pian*, one of many silk-bound books buried with King Ma in his tomb, was known to contain numerous explications of qigong, and included an appended nerve meridian chart. It is clear that the study of qigong in China has a history of at least 2000 years, and is, moreover, still developing.

Qigong is unique in that it brings into full play the theory behind controlling bodily functions. That is to say, the core issue of qigong centers around the dialectical unity of *yi* and *qi* (awareness and inner energy) and the *shen* and *xin* (body and mind). Coordinated meditation in the three mechanisms of *xin* (mind), *xi* (breath) and *shen* (body) leads to the dialectical unity of the antithesis between activity and tranquility, and between ease and tension, thereby placing the body in a special functional state. In accordance with its different applications, qigong may be divided into hard (or martial arts) and soft qigong, the main uses of which are in preserving health, exercising the body, and dispelling sickness. These categories, in turn, consist of both inner and outer qigong. In their article "Physiological Science Represents a Prominent Branch of the Modern Scientific Technical System," Qian Xuelin and others

point out that "from the perspective of applied modern systems science, the human body is an enormous system which interacts with the surrounding universe. Thus, it is not a closed system, but an open one, interlinking with the entire universe." They believe that a salient feature of the human body is its "holistic functional state." They explicitly point out that when a qigong master meditates, his body enters a "particular functional state: the qigong state." This fact is significant in directing the course of qigong research. The universal energy of Prana, as contemplated in the early tradition of Hinduism, is regarded as the basic component and source of all life. This life-sustaining energy was referred to as *qi* by Chinese scholars well before 300 B.C.

20th Century research has revealed that the human body possesses an aura, which is a manifestation of universal energy and is connected to the body's life-sustaining breath. It has been described as a form of radiation that not only emanates from the body, but also permeates it, and has been referred to as *qi*. In recent years, Ricardo Dublin, Barbara Conway and others, have used photoelectric multiplier tubes and television picture processing technology to document the energy field surrounding the body. The majority of the energy field's optical frequency bands lie in the ultra-violet and blue light ranges of the electromagnetic spectrum. In cooperation with the United States Television Engineers Group, and employing specially designed transmission equipment, they succeeded in documenting signs of *qi* emanating from the body. Since 1978, international qigong academic conferences in Prague, Monaco and Toronto have carried out this same experiment. In 1978, the principles and applications of qigong were discussed in the American journal Bio-Feedback, in the Canadian journal Bio-Feedback Therapy, and in the French journal Bio-Energy and Chinese Medicine. In October of 1976, the British Journal of Nature published an article by Ireland's Dunkenkirk Observatory director Professor Jiang Tao. In his article, Jiang gave a rather high appraisal of *yunqi*, or the qigong art of directing one's strength, through concentration, to specific parts of the body. In addition, a bio-feedback apparatus has been invented in the United States, a device which can automatically provide a read-out of blood pressure, heart rate, and other physiological changes in the practitioners of qigong who use the device. This allows the user to regulate his or her body with very little time lag. In 1978, a Switzerland's Maharishi European University carried out comprehensive biochemical and psychological research on qigong.

Chinese medical research on qigong falls into two main categories: applying qigong to the clinical treatment of diseases, and utilizing modern medical equipment and experimentation methodologies to conduct observations on the physiological effects of outer *qi* as induced by inner *qi*. Modern science has proven that the existence of *qi* has a material basis.

The magnetic field of outer *qi*, its static charge, infrared radiation, and infrasonic sound, have all been measured.

Research has revealed insights into the general physiological effects of outer *qi* on the lymphocyte immune function of mice, as well as the effects of *qi* on blood pressure, the heart, and the stomach. Analysis of electroencephalogram (EEG) charts has shown that exceptional qigong practitioners can influence the brain functions of their patients. On the cellular level, systematic observations have enable scientists to detect the effects of qigong on gram-negative bacilli, negative coccidia and cancer cells. Scientists have also observed the effects of qigong on the myocardium cells of mice. At the molecular level, qigong has been observed to increase the CAMP-count in blood samples, as well as DNA synthesis in human limbic cells. It can also alter the molecular structure of water, glucose, and lipids. Others have observed qigong's effect on plant cells. Research in embryology, pathology, and immunology has been carried out to investigate the quiescent state entered by a qigong master as he meditates.

Foreign scholars have also investigated physiological changes that occur during transcendental meditation and yoga. Gellhorn has observed that alpha-waves increase during meditation and brain wave frequencies decrease, producing theta-waves. Pulse, breathing rate, and oxygen consumption fall. This led Gellhorn to speculate that meditation is a nutritive reaction. Bonguet points out that during meditation, alpha-waves spread from the frontal lobe to the occipital lobe, suggesting that changes in brain wave patterns vary depending on one's state of alertness. McCuaig (1974) reported that potassium, sodium, calcium, and magnesium electrolytes in saliva increase during meditation. Jevning pointed out that heart output increases during meditation. Still others have observed the use of yoga in the treatment of high blood pressure and its influence on blood coagulation.

Chinese scholars have done studies on a variety of living organisms and on the major bodily systems in order to understand the physiological changes that occur during meditation.

- In the circulatory system, they have observed changes in blood pressure, heart activity, blood circulation to organs, and minor blood circulation in connection with the qigong state. They have proven that qigong can increase heart output and regulate heart pressure.

- In the respiratory system, breathing and aeration rates, gas metabolism, and oxygen content in artery blood all decrease in the qigong state.

- In the digestive system, the qigong state causes an increase in gastric activity, stomach evacuation, gastric juice secretion and the SIgA content of saliva.

- In the endocrine system, adrenaline and lactic acid levels drop.

- In the nervous system, electric potential in the cerebral cortex rises. EEG observations of qigong have developed exponentially, from simple brain wave models to more elaborate ones. New models use functional analysis and AR modelling to pick up on the special characteristics of the brain's electrical activity.

The major indications of brain wave changes in the qigong state are that alpha-wave cycles become extended, their amplitude rises as their frequency falls, and brain waves spread from the occipital to the frontal lobe. As theta-waves appear, they join alpha-waves in spreading toward the frontal lobe. In the resonance frequency zone, the qigong state causes frontal lobe brain waves to exponentially increase. This suggests that the qigong state varies depending on whether one is asleep, falling asleep or simply relaxing. Using evoked electric potential accumulation technology to observe electrical changes in the brain stem and cerebral cortex reveals that the cerebral cortex becomes inhibited and that the brain stem becomes lax during the qigong state. The key to successfully practicing qigong is to relax the body and settle the spirit. In this meditative condition, changes in the cerebral cortex functions can be observed by metric analysis of evoked potential changes in the cortex. This points to commonalities and differences between brain activity in the occipital and frontal lobes and offers a new clue in explaining changes in the cerebral cortex during the qigong state. The spinal column maintains the body's muscle tone. When qigong masters meditate, they relax their bodies, and some exhibit startling feats of strength. Thus, observing EEG changes is significant for understanding spinal functions during the qigong state.

## 1. Methodology

### 1) Spinal Evoked Potential (EESG) Recording Methodology

Because the evoked potential response of a body surface recording center is at the micro-volt level, they are often obscured by spontaneous electrical activity and noise, and due to recent advancements in electronic biological technology, non-damaging technology for sensing evoked potential recording has been produced, which uses computer accumulation to clearly bring out evoked response in a disordered background of spontaneous interference.

Early on, in 1933, Gasser and Graham recorded an evoked potential on the surface of a cat's spine. Later, several scientists in succession conducted research on externally stimulated all nerve evoked spinal potential of using humans or animals, making continuously deepening our knowledge of these potentials. General attention has been given to taking externally stimulated all nerve and evoked spinal potentials as sensitively

and objectively reflecting spinal function electricophysical indices. According to documentary reports, these potentials can be used in determining the functional condition of the spine, spinal development and damage, and other supplementary diagnoses of spinal pathological changes. For this reason, research on spinal electricophysical functions possesses major theoretical significance and use value. Animal tests show that the epidural to surface potential latency period is prolonged, the wave width is reduced, there was no difference in the wave time and frequency.

Because the body surface recorded EESG voltage is very small, only several micro-volts or less than 1  $\mu$ V, in comparing it with the interference of the ECG, which is on the order of ten times larger, and the EEG, which is several tens of times larger, and the electromyographical interference, it is very difficult to record an ideal wave, and it is necessary to solve some technical problems and requires excellent instruments and the close cooperation of the test subjects. In China in 1984, Li Wenbin and others used an induced central (mesal) nerve and recorded the surface evoked potential of the human neck, requiring 1024 superpositions. Abroad, Cracco and Yamada et al. have done a lot of work in research of spinal surface evoked potentials. Cracco used a method involving a surface induced central nerve and a calf nerve to record a surface EESG for the entire spine during walking. There were 1024-8192 superpositions, and before the test for one hour the subjects were given 1-1.5 g of hydrochloral to help the subject relax. Using the earlobe as the reference, the stimulated central nerve had the highest potential, 3  $\mu$ V, recorded on the neck, and the used bidirectional voltage is quite small. The stimulated calf nerve, with 1024 superpositions, had the greatest potential recorded using a bidirectional under the chest area, though the voltage was only 0.5  $\mu$ V, and the potential in the neck was quite difficult to recognize, and after the superpositions reached 8192, in the cervical area it was possible to see an average evoked potential of 0.2  $\mu$ V, from the tail section to the top of the head, the voltage range got progressively smaller, and the latency time was correspondingly extended. According to accounts of several documents, recorded EESG at the least require 1024 superpositions or more, and are not very useful for test research on qigong. For this reason, we adopted the use of R wave triggered technology, and obtained more ideal results.

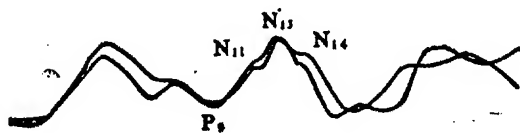
In addition, the use of sedative medicines inevitably has an effect on the functional state of the cerebral cortex, and is not beneficial to the observation of a qigong master entering the quiescent state. In order to allow the qigong master to normally enter this state, it is only possible to make the test subjects comfortably recline on their backs on a test bed within a shielded room or to sit up straight on a sofa, with their muscles relaxed as much as possible. Though an increased level of



stimulation or the simultaneous stimulation of both nerves can cause a substantial increase in the recorded EESG potential, in practice it is possible to clearly effect the qigong master entering quiescence, therefore it was also not done. Because when stimulating the nervus medianus is far more easy to guide the EESG than with the calf nerve, we used a 6 mm diameter silver plated electrode on the cervical skin surface for recording, and stimulated the wrist section of the central nerve, with one side of the mastoid process serving as a reference, and the stimulating electrode on the near side using a strap type electrode ground. Alcohol was used on part of the skin for degreasing, and the electrical resistance of the electrode contact was less than 5 k $\Omega$ .

In order to reduce the electromyographical interference of the limbs activity in the limbs, encountered on the chest path of the ECG. Taking an ECG path enlarger and after enlargement, using an R wave trigger stimulator, and at the same time taking the ECG and stimulator output signals and inputting them into an oscilloscope and observing them, and adjusting the stimulator output delay, on the oscilloscope the observed stimulating signal in the ECG T-P section is suitable, the normal time delay is 350-500 ms. The time-delayed stimulating signal trigger "Neuropack-II" carries out synchronous superposition and simultaneous stimulation of the central nerve, with a stimulating voltage of 60-100 V, taking the thumb having clear shrinkage as the measure. The stimulating wave width is 0.1 ms, and with a filter bandpass of 20-3000 Hz, an analysis time of 20 ms, and 128 superpositions it is possible to obtain a comparatively ideal wave, and this substantially shortens the test time. During the testing of the 30 normal subjects, the EESGs of C<sub>2</sub> and C<sub>7</sub> were recorded at the same time, and the wave group P<sub>2</sub>, N<sub>11</sub>, N<sub>13</sub> and N<sub>14</sub> were clearly recorded, and are basically consistent with the recorded results in the literature, as shown in Fig. 1.

Fig. 1 EESG of normal subjects recorded at C<sub>7</sub>



## 2) A determination of the cerebral cortex potentials (SEP)

We selected a 6 mm diameter silver plated electrode for use, with a contact resistance between the electrode and the skin of no less than 5 k $\Omega$ , in the same test maintaining the electrode position of each subject identical. The recording electrode was positioned on the opposite side of the stimulating electrode in the scalp somatosensory region, and was 2 cm behind the crest and

4 cm on the sagittal side, while the reference electrode met the mastoid process, and the stimulating electrode was close to the side using a strap electrode ground. The stimulating intensity took thumb having clear shrinkage as the measure. The Japanese produced evoked potential recording unit "Neuropack-II" was used for recording. The filter bandpass was 2 Hz-1000 Hz, and the stimulating wave width was 0.1 ms, the superposition frequency was 2 Hz, the analysis time was 200 ms, and there were 256 superpositions.

### 3) Experimental subjects and testing sequences

The total number of tested qigong practitioners was 30, with varying practicing times ranging from 2 to 40 years. The subjects muscles were relaxed, their minds calm, with determinations done while sitting up straight or laying on their backs in a shielded room, as far as possible reducing the noise and light interference coming from outside. First, EESG and SEP curves under normal conditions were determined twice as an individual reference; then the qigong practitioners entered the quiescent state, and after 10 minutes in this state the evoked potentials under the qigong state were determined twice; after a 10-30 minute rest, observations were done of the potential changes after the return to normal.

In addition, 30 non-practitioners were selected for a comparison of normal situations, closely following the test group's three test process, and SEPs and EESGs were recorded over the corresponding time.

### 4) Measurements and data processing

The latent time obtained between the time from the start of stimulation to the highest point of each wave peak and the base line perpendicular line, is the peak latency time. The amplitude of the SEP is obtained from the peak-to-peak value between the previous P wave trough and subsequent N wave peak. The EESG obtained  $P_{10}$  to  $N_{14}$  peak-to-peak value is (A). Within each series, an average value was obtained of the twice recorded curves, and all the original data is input to the computer, which does a before qigong, during qigong and after qigong individual collation T test.

## 2. Results

### 1) Changes in the EESG in the qigong state

The EESG in the neck region were recorded using the  $P_{10}$ ,  $N_{11}$ ,  $N_{12}$  and  $N_{14}$  wave group, and the results are in agreement with those recorded by Kimura, Yamada and John, et al. In the normal simulated qigong group collation test, their amplitudes and latency time changes had no significant meaning, as shown in Fig. 2 and in Table 1. The total number of people measured in the qigong state was 30, with 21 during qigong EESG amplitudes clearly dropping, from before qigong at  $1.84 \pm 0.59$ , during qigong,  $1.03 \pm 0.59$ ,  $p < 0.001$ , a drop of 44%. The  $p_{10}$  latency time was

slightly extended, from before qigong at  $9.64 \pm 0.86$ , to during qigong at  $9.89 \pm 0.86$ ,  $P < 0.05$  (see Fig. 3 and Table 2. The other 9 qigong practitioners after entering quiescence had a rise in EEG amplitudes, from before qigong levels of  $1.31 \pm 0.39$ , to during qigong levels of  $1.97 \pm 0.73$ ,  $p < 0.01$ , a rise of 50.4%, while the latency time clearly changed, as can be seen in Fig. 2 and Table 2. During test recording it was also possible to note that the qigong state EEG curve change was not stable, and in the neiyanggong qigong state, the majority of EEG amplitudes were reduced.

Fig. 2 Normal state EESG

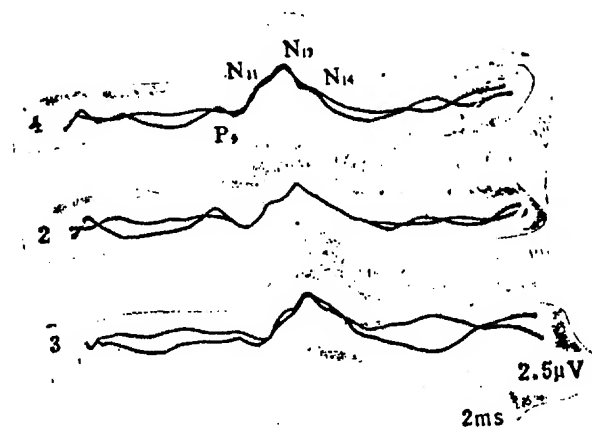


Fig. 3 Influence of qigong state on the EESG

Yu XX, Male, 56 years old;

1- before qigong; 2- during qigong; 3- after qigong

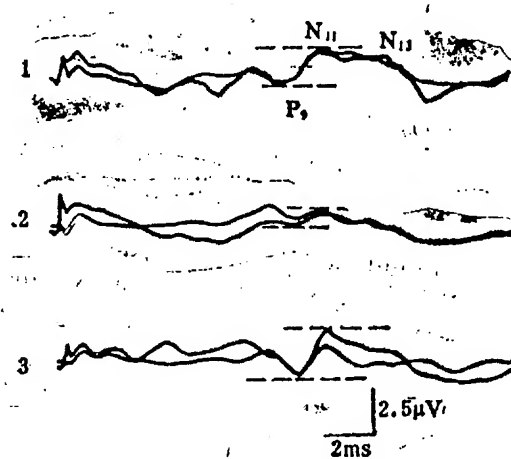
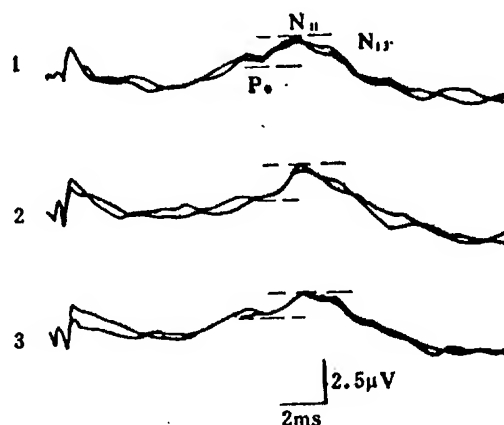


Fig. 4 Influence of qigong state on EESG

Li XX, male, 21 years old;

1- before qigong; 2- during qigong; 3- after qigong

Table 1  
30 normal tested EESG ( $\bar{X} \pm SD$ )

	A	P <sub>0</sub>	N <sub>12</sub>
Before	$1.76 \pm 0.41$	$9.63 \pm 0.71$	$12.19 \pm 0.85$
During	$1.71 \pm 0.39$	$9.63 \pm 0.75$	$12.15 \pm 0.84$
After	$1.69 \pm 0.49$	$9.67 \pm 0.81$	$12.17 \pm 0.87$

 $A(P_0 - N_{12})$  AmplitudeTable 2  
Changes in EESG for 30 subjects before, during and after qigong state ( $\bar{X} \pm SD$ )

Group one n = 9

	A ( $\mu V$ )	P <sub>0</sub>	P <sub>12</sub>
Before qigong	$1.31 \pm 0.39$	$9.55 \pm 0.65$	$12.11 \pm 0.83$
During qigong	$1.97 \pm 0.73^{**}$	$9.65 \pm 0.67$	$12.24 \pm 0.92$
After qigong	$1.56 \pm 0.49$	$9.73 \pm 0.69$	$12.18 \pm 0.87$

group two n = 21

	A ( $\mu V$ )	P <sub>0</sub>	P <sub>12</sub>
Before qigong	$1.84 \pm 0.59$	$9.64 \pm 0.86$	$12.2 \pm 1.21$
During qigong	$1.03 \pm 0.59^{***}$	$9.89 \pm 0.86^*$	$11.99 \pm 1.29$
After qigong	$1.68 \pm 0.51$	$9.84 \pm 0.76$	$12.24 \pm 1.20$

## 2. Changes in the SEP in the qigong state

The SEP is composed of a comparatively complex wave group, and according to its potential wave motion position and sequential distribution they are called  $P_1$ ,  $N_1$ ,  $P_2$ ,  $N_2$ ,  $P_3$ ,  $N_3$ ,  $P_4$  and  $N_4$ , and for this test the recorded results and those reported by domestic and foreign scholars were basically in agreement. For the normal reference group, the amplitude of each wave and the latency time change had no clear significance. When in the qigong state, the changes in these waves were quite complex, and each wave had a rise and a fall, while the changes in the latency time had no clear significance. Taking the group with rises in amplitude, the rise of each wave amplitude had clear significance or very clear significance, and the course of change was different. For the other group during the qigong state with amplitude drops, the amplitude drop for each wave was clearly significant and the course of change was different, as may be seen in Fig. 5, Fig. 6 and Table 3. For the testing case of those subjects who repeatedly entered the quiescent state, it was possible to see a repeatable results, though the same subjects second test results at a different time could be different.

Fig. 5 Influence of the qigong on SEP

Cao X, male, 20 years old

1- before qigong; 2- during qigong; 3- after qigong

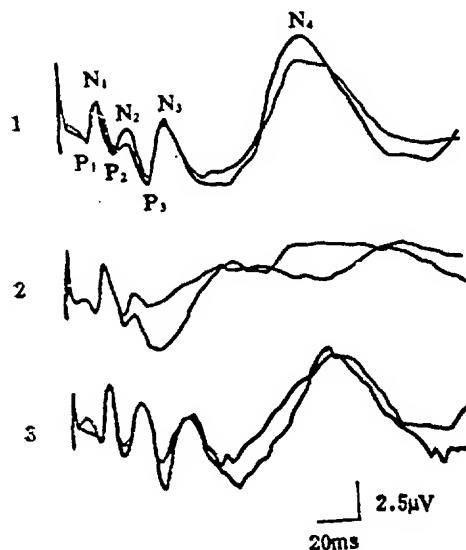


Fig. 6 Influence of the qigong state on SEP

Cao X, male, 20 years old

1- before qigong; 2- during qigong; 3- after qigong

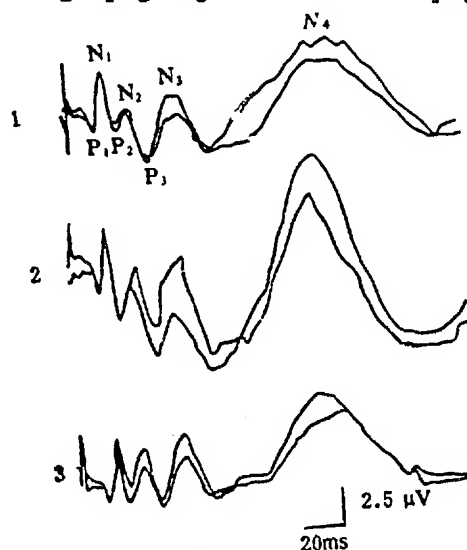


Table 3

Changes in SEP for 30 subjects before, during and after the qigong state ( $\bar{X} \pm SD$ )

	$N_1$		$N_2$	
	A( $\mu V$ )	L(ms)	A( $\mu V$ )	L(ms)
Before qigong	$3.20 \pm 1.02$	$20.15 \pm 1.18$	$1.48 \pm 0.58$	$33.24 \pm 3.23$
During qigong	$2.75 \pm 1.11^{**}$	$20.15 \pm 1.30$	$1.06 \pm 0.60^{**}$	$33.76 \pm 3.51$
After qigong	$3.16 \pm 0.89$	$20.38 \pm 1.27$	$1.50 \pm 0.82$	$33.24 \pm 4.49$
Before qigong	$3.49 \pm 1.05$	$20.9 \pm 1.22$	$1.65 \pm 1.09$	$33.67 \pm 2.13$
During qigong	$4.09 \pm 1.19^{***}$	$20.86 \pm 1.19$	$2.37 \pm 1.53^{**}$	$34.56 \pm 2.65^*$
After qigong	$3.52 \pm 1.22$	$20.66 \pm 1.42$	$2.17 \pm 1.43$	$34.11 \pm 2.42$

Table 3 (continued)

Changes in SEP for 30 subjects before, during and after the qigong state ( $\bar{X} \pm SD$ )

	$N_1$		$N_2$	
	A( $\mu V$ )	L(ms)	A( $\mu V$ )	L(ms)
Before qigong	$3.37 \pm 1.52$	$58.24 \pm 4.17$	$6.38 \pm 2.33$	$118.6 \pm 7.5$
During qigong	$2.32 \pm 1.85^{***}$	$57.99 \pm 4.00$	$3.01 \pm 2.64^*$	$115.4 \pm 6.62$
After qigong	$2.79 \pm 1.21$	$58.15 \pm 4.36$	$5.04 \pm 1.60$	$120.2 \pm 7.05$
Before qigong	$4.33 \pm 1.26$	$56.67 \pm 4.12$	$5.27 \pm 2.12$	$126.0 \pm 7.91$
During qigong	$5.17 \pm 1.17^*$	$59.43 \pm 4.99$	$7.73 \pm 2.19^{**}$	$126.1 \pm 4.91$
After qigong	$4.95 \pm 1.49$	$58.17 \pm 4.88$	$5.69 \pm 1.52$	$124.2 \pm 4.06$

### 3. Discussion

#### 1. Changes in the EEG under the qigong state

In a normal state, after stimulation of the nervus medianus, after excitement of the nerve's shallow sensation component, there is an exchange of neurons through the posterior root nuclear mass to the posterior horn, and through the alba presynaptic intersection to the other side, from the tractus spinothalamicus up to the thalamus; and the deep sensation side through the posterior root medial section to the back of the spine, it goes to branches on the homonymous posterior cord and up, reaching the lower spinal nucleus funiculi gracilis and the rear of the nucleus fasciculus cuneatus to exchange neurons, and finally emerging from the fiber intersection to the opposite side, and through the medial lemniscus to the thalamus. The potential changes of this neural excitement can be recorded on the spinal skin surface, and is different depending on the recording method, and the wave shape obtained is also different. In the tests of Yamada and Kimura, on the cervical region skin surface  $C_2$  could be recorded at  $P_2$ ,  $N_{11}$ ,  $N_{12}$  and  $N_{14}$ , at  $C_7$  it was possible to record  $P_2$ ,  $N_{11}$  and  $N_{12}$ . In addition, there are a lot of authors who have obtained similar results. When stimulating the nervus medianus, the sources from where these waves came are also rather different. The view of many scholars is that  $P_2$  comes to the brachial plexus nerve, and tests reveal that the latency time of  $P_2$  and the stimulated lateral clavicle area recorded movement potential latency time are similar, and for  $C_2-C_7$  spinal root pathologies patients, the nervus medianus potential in the cervical skin surface is not recorded.  $N_{11}$  is a reflection of the nerve root excitement entering into the back of the spine, and its emergence shows that the nerve excitement has reached the  $C_2-C_7$  region, and there is synaptic forward potential.  $N_{12}$  arises in the posterior horn 1 V-V layer potential, representing the synaptic rear neuron activity, its sustained time is long compared to  $N_{11}$  and  $N_{14}$ , and there are tests which show that in humans  $N_{12}$  is commensurate to the first negative potential of the spinal surface potential in monkeys and cats, and this wave arises from the value value lowest  $A_2$  passing into the fiber, using a micro electrode position its greatest value on the posterior horn 1 V-V layer.  $N_{14}$  comes to the medial lemniscus, because  $N_{14}$  appears 2 milliseconds behind  $N_{11}$ , and it is not able to produce on the spine, and in high spinal semitranssection patients  $N_{14}$  disappears, and when there are thalamus pathologies in the sensation conduction paths,  $N_{14}$  still exists, so it is believed that this wave arises in the medial meniscus.

The spine as considered the basic adjustment center of the human body's movement, and normally in the spinal anterior horn there is a large amount of motor neurons, including  $\alpha$  and  $\gamma$  motor



neurons, and their axons through the front root are separated from the rear of the spine through the controlled muscles. The a motor neuron size is not uniform, and a large a motor neuron controls the quick muscle fiber. A small a motor neuron controls the slow muscle fiber. An a motor neuron accepts peripheroafferent information from the skin, muscles and joints, and also accepts high-level information transmitted down from the brain stem to the cerebral cortex, producing a certain efferent excitement. For this reason, a motor neurons are the final highway of spinal movement reflexes. The  $\gamma$  motor neurons cytosomes are scattered among the a motor neurons, and their cytosomes are small compared with a motor neurons. The  $\gamma$  motor neuron axons are also separated from the spine through the front root, and control the intrafusal muscle fibers of the skeletal muscles. The excitability of  $\gamma$  motor neurons is quite high, and normally have a high frequency sustained discharge, in quiet and sedated animals it has been observed that even if the a motor neurons do not discharge electricity, some of the  $\gamma$  motor neurons still continue to discharge. Under normal conditions, when a motor neuron activity is increased, the activity of  $\gamma$  motor neurons is also increased, and hence adjusting the sensitivity of the muscle-spindles to tensile stimulation. The a motor neurons control the muscle fiber outside the spindle, and the  $\gamma$  motor neurons control the muscle fibers within the spindle. When the  $\gamma$  efferent activity is strengthened, the muscle fibers within the spindle contract, and this can increase the sensitivity of the receptors within the muscle-spindles. For this reason, the activity of  $\gamma$  efferent fiber has a major effect on the adjustment of the spindle stretching reflex. Tendon members are the receptor positions for receptor muscle tension, and their afferent excitement has a restraining function for unified muscle a motor neurons, and the afferent excitement of muscle-spindles has a stimulant effect on unified muscle a motor neurons. When the muscle accepts retraction, first, the stimulated muscle-spindle receptor site launches a stretch (myostatic) reflex, and the affected muscle retracts with an opposite retraction; when the retractive force is progressively increased, then it is possible to stimulate the tendon and constrain the stretch reflex, in order to avoid having damage caused by the retracted muscle. The spine's adjustment for the muscle movement is to accept control at a higher center. The high center has an easing effect and restraining effect on the spinal reflex. Some people use an orientation device to stimulate different regions of animal brain stem netted textures, and have revealed that in the netted textures, there are regions that restrain muscle tension and muscle movement. These are called restraining regions. There are also regions that strengthen muscle tension and muscle activity, and these are called easing regions. Under normal circumstances, the activity of the easing regions is comparatively strong, and the activity of the restraining regions

is comparatively weak. For this reason when adjusting the balance of muscle tensioning, the easing regions are slightly more dominant. The other cerebral cortex movement regions, the corpus striatum and the cerebellar epivermis both have a muscle restraining function, and the nucleus vestibuli and the cerebellar epibilateral regions also have a muscle tension adjustment function. These muscle tension restraining regions outside the brain stem not only serve to strengthen the netted texture restraining region activity, and restrain muscle tensioning, but also are able to control the netted texture easing regions, and restrain the activity of the easing regions, shifting and reducing muscle tensioning. The function of the netted texture restraining regions and the easing regions vis-a-vis muscle movement, is primarily passed down through the netted texture spinal fasciculus; the easing region passed down fiber compared with the restraining region passed down fiber is slightly on the back side, but the two have overlapping locations. Tests prove that when the easing region is stimulated, the muscle-spindle efferent stimulation is increased, and when the restraining region is excited, the muscle-spindle afferent stimulation is reduced. Research conducted by Chinese medical science institutes in recent years on the spinal anterior horn motion columns indicates that: the central nervous system breast-fed mammals contains Golgi silver-plated chromosome heterophile dendritic structures-- phobc-Golgi dendrites. The alba dendrites of the anterior horn motor neurons of mice and rats stretch into the alba funiculus, and extend under the mantle, forming a dendritic clump under the mantle. It was revealed that the central functional return path has been extended from traditional "nucleus return path," to the "lateral return path," not only shaking the sharp dividing line definition based on the classic spine of Golgi's law, with a spine that is more anatomy related spinal greyish white quality, but also has major significance for a fresh consideration of the spinal anterior horn motor neuron's normal activity and function adjustment. When a qigong practitioner enters the qigong state, the EESG shape shows a potential amplitude rise and a reduction in two types of changes, a restraining and an easing effect. There are also tests which prove that in the qigong state, there is a rise in the sense of hearing brain stem induced potential amplitude, and the brain stem is in the easing condition. It is possible to imagine that in the qigong state it is possible that due to the brain stem yielding to the restraining system or the easing system, by easing and producing different results for the spine. After the restraining region is eased, through sending down the IPSPs of the restraining system to act on the  $\gamma$  motor neurons of the spinal anterior horn, the efferent fibre activity is weakened and the within the spindle the muscle excitation efferent is reduced, while at the same time the a motor neuron activity is weakened, producing a relaxing of the muscles. According to Wanxuancaideng

theory, when a dendritic clump of motor neurons arrive at the alba up to under the mantle, the hyperpolarization electrical tension potential of  $\gamma$  motor neurons restrains spinal activity, and restrains EPSP reception, displaying after excitation of the nervus medianus, and the recorded EESG is reduced, the stretch reflex is weakened, the muscle tensioning falls, and there is a slackening effect on the qigong state entering quiescence. When the brain stem netted texture easing region is being eased, through the reticular spinal fasciculus first there is a change in the activity of the  $\gamma$  motor neurons, increasing the  $\gamma$  efferent fiber excitation frequency, increasing the contraction of the muscle fiber within the spindles, and possibly increasing the sensitivity of the receptor sites within the spindles. When the afferent excitation within the spindles increases, the stretch reflex activity is strengthened and the muscle tensioning is also increased. Due to the increase of motor neuron activity, the excitability of the  $\gamma$ , a motor neuron and the potential activity increase, and the dendritic excitation of the motor neurons distributed under the alba and mantle causes easing of the spine, the EESG is increased, thereby displaying a rise in EEG voltage. Normally, after the tendon members receive retraction, a restraining effect is produced on the  $\alpha$  motor neurons, restraining the stretch reflex, and it is possible to avoid damage caused by a retracted muscle. When in the qigong state, it is possible to infer that due to spinal anterior horn motor neuron easing, the tendon member afferent negative feedback is blocked, so that supernormal muscle power is produced. Because this experiment was only looking at the objective changes in the subjects EESG when entering the qigong state, and has not yet touched upon questions of qigong methods, the two types of changes only a preliminary discussion can be made concerning inferences about possible mechanisms of the qigong relaxing and the supernormal muscle strength produced, and when it comes to different qigong methods, further research should be directed towards studying the detailed mechanisms involved in muscle relaxation and the production of supernormal muscle strength.

## 2. Changes in the cerebral cortex evoked potentials in the qigong state

Cerebral cortex evoked potentials are sensed when the afferent system receives stimulation, and in the cerebral cortex, a certain limited region gives rise to potential changes. A determination of the changes in the cerebral cortex evoked potentials in the qigong state can serve as an objective index of the functional state of the cerebral cortex. The cerebral cortex has  $10^{10}$  neurons, the total number of synapses can reach  $10^{14}$ . Based on this, we can consider that the information capacity of the cerebral cortex is very large, and the functions of the cerebral cortex are extremely complex. At present, the functions

of a large portion of the structure of the cerebral cortex, particularly those structures which have developed to a high degree during evolution, are far from being understood. The human brain is a huge system, which constitutes a specific state in the midst of complex movement and mutual effects. Professor Qian Xueshen points out that each functional state has a different quality, and the human brain can have many functional states. We already know about the sleep state, the hypnotic state, emergency, awakening, attention, etc. At present many people believe that the qigong state is a special functional state of the brain, and the qigong state can aid in exploiting the latent power of brain functioning. Some people equate the qigong state to special functions turned over to the activity of the right hemisphere of the brain. The work of Mei Lei and others considers the dominant function of the frontal lobe, and when in the qigong state, a clear frontal lobe brain wave ordering appears. Normally in the dominant a synchronous peaks in the occipital lobe clearly shift to the frontal lobe, and the power of the a synchronous peaks shows a lengthening and increase in the wake of exercise history. Those senior qigong practitioners who have been practicing for many years have a typical a wave super-synchronization, taking the frontal lobe as primary, and it is also possible to have it expand out from the frontal lobe to the entire brain, making the entire brain entire an ordered oscillation. Using a large-scale computer model techniques, successive scanning was conducted every two second for the synchronous peaks of a brain wave power spectrum, and it was revealed that these synchronous peaks are at an extremely low frequency (4-10 cycles/sec) and have a regular rises and falls. This extremely low frequency and the ultraslow rhythm are very consistent. This ultraslow rhythm is only observed in the frontal lobe and hypothalamic pituitary system. Hence it is believed that when in the qigong state, under conscious function, the latent connections in the frontal lobe- hypothalamus-pituitary system are opened up, thereby making active control of the internal organs possible. This is one manifestation of the latent capabilities of the human brain. The research of neural biologists demonstrates that processing of information in the brain is layered, and after each type of information enters the brain, it first reaches each the relevant elementary cerebral cortex layer which conducts processing, and then is transmitted to adjacent layers of the sense cortex and sense association cortex, where the first step of processing is done. Later, they assemble in the crown-temple region association cortex, and finally sent out and assemble at the front lobe cortex. The transferring process for information in the brain is really progress processing in different layer neuron return paths, conducting a process with different degrees of analysis, integration, abstraction, generalization and reasoning. The higher the neural return path layer, the higher the level of

abstract reasoning, and the more complex the thought functions. When in the qigong state of accepting conscious thought control, the cortex functional changes of the organism are also quite complex. When in the qigong state, the sense of hearing and the sense of sight induced potentials are clear, the amplitude of each wave is reduced, and the potentials can be controlled. Due to the complex nature of the functioning of the nervous system, the SEP changes we have observed in the qigong state are also rather complex. The SEP is composed of a wave group, and the explanations for the source of each wave are still divergent, especially for the long latency time component. The  $P_{14}$  produced by excitement of the nervus medianus in the contralateral cerebral cortex region is primarily indicates that the top nerve excitement of the medial lemniscus has reached the thalamus, and therefore the brain stem damaged patients seem to have a  $P_{14}$  that is abnormal, and when the thalamus is damaged, only very few of the patients'  $P_{14}$  are abnormal, therefore we may infer that the primary source of  $P_{14}$  is in the brain stem, particularly the medial lemniscus, and part arises in the thalamus.  $N_{20}$  originally arises in the cerebral cortex and is subordinate to a distinctive feature of the thalamus-cortex radiation. In patients with a diseased cortex and internal capsule this wave is abnormal, and it is commonly considered that it arises in the parietal lobe cortex, and is the first cerebral cortex potential, and is a primary component. Because for  $N_{20}$ ,  $N_{25}$  and  $N_{30}$  in certain pathologies selectivity disappears, we should point out that it is possible to distinguish through certain independent paths projected from the thalamus to the cortex. Experimental research and clinical observation show that in addition to the major pathway through the spinal rear standing pillar medial meniscus, there is also another conduction path.  $P_{27}$ ,  $N_{30}$  and  $P_{40}$  disappear when there is damage in the top (crown) region, and when there is damage in the frontal region, they are not effected. It is believed that it is possible that they originate at the postcentral sulcus crown region.  $N_{30}$  is distributed more widely, and the different parts of  $N_{30}$  recorded can at the same time or separately be disrupted. This indicates that the  $N_{30}$  series involves early component and many different types of afferent paths, and expanded projection to the opposite side of the cortex. There are tests in which it is believed that  $N_{30}$  is originates from a synaptic lateral lemniscus passage. The work of Goff indicates that the early component has a more limited distribution in the excited lateral corresponding sensory projection region, and the amplitude is lower. This is believed to reflect the activity of a distinct projection system. Research has clearly shown that the SEP can be divided into three components, the Primary Response, made up of  $P_1$  and  $N_1$ , with a latency time of within 20 ms, and representing the activity of the first sensory region of the cerebral cortex;  $P_2$ ,  $N_2$ ,  $P_3$  and  $N_3$  are the Secondary Response, with a latency time of within 60

ms, and representing the potential activity of the second sensory region and synapsis region of the cerebral cortex; the latency time of  $P_4$  and  $N_4$  is above 60 ms, and they are called the After Discharge, and continue to emit components, representing the dispersion activity of the both sides of the cerebral cortex. This component is also called the late component. Shagass considers the early component and the transmission process of information entering the central nervous system to be related, and the late component then touches on related activity involved in the processing of this information. Ivdnitsky believes that the early component could represent the estimation of the cerebral cortex of the excited physical parameters, and to be closely related to the sensory information of consciousness. He also holds that the late component could reflect the significance of the stimulation on the receiver of stimulation and conscious non-sensory information. There are tests which show that the SEP early component, under the effect of various factors influencing attention, remains stable, and the late component easily accepts the influence of consciousness, attention and other factors. There are some late wave phenomena that are related to certain mental activity. Because the SEP itself is very complex, the cerebral cortex potential change of a qigong master when he enters quiescence also has comparatively large individual differences. Some of the subjects at different times used similar measuring conditions and achieved results which were also rather different. Because the mechanisms of the SEP contributing factors are explained differently, it is difficult to make an accurate judgement concerning the significance of changes in the SEP in the qigong state. Huang Shendu observed 9 changes of SEP in the qigong state. He discovered that the majority of the subjects during qigong after 100 ms had an amplitude drop for the late component, and the wave change was more clear. This is because the late component is related to the functional state of the brain stem reticulated structure and the non-distinct projection system, and during the qigong process, through the body adjusts the upper restraining influence produced by the sensory transmission of the reticulated structure, thereby reducing the SEP amplitude and making some of the components disappear. Zhang Wenbin points out in an initial report regarding the qigong entering quiescent state SEP changes that the early component does not change and the late component is reduced in the majority of cases, and there are a few qigong practitioners whose early and late components were both reduced or the early component changed slightly and the late component increased, reflecting the inconsistent nature of the SEP wave changes. In the given tests the  $N_1$  wave discovered with a latency time of 20 ms to the  $N_4$  wave with a latency time of 120 ms both had an increase and decrease (two kinds of change), though the process of change was different, as the change of the late component was more marked than that of the early component. During some tests differing

changes were observed in each wave, and during the qigong state there were some with amplitude value increases and some with amplitude value reductions, and this can be repeated. For example, during some tests, after entering quiescence each wave amplitude saw a clear increase, and after resuming the before qigong state and again entering quiescence each wave again clearly increased. Because the late component and the early component pass through different distinctive projection paths to reach the cortex expanded region, these waves easily accept the influence of conscious, attention and thought, etc. mental factors, and is related to high level activity involving information processing in the cerebral cortex, therefore, its changes are also comparatively large, and the qigong quiescent state easily affects these components. The early component is produced from the distinct spinal fiber efferent, and it is not easily influenced by attention and other mental factors. Under the qigong state the auditory and visual cortex evoked potentials are restrained, and the changes in the SEP are both restrained and have an increased effect. In addition, in the same series of tests, there were some increases in amplitude, and there were some decreases. It can be seen that the cerebral cortex sensory region under the qigong state is able to have both a restraining and an easing effect. This has significance for further explanation of the theory of "yishou (anticipating and watching)" and "represent the many in one." The origin of each SEP wave is different, and is represented by the activity of different neural regions. The inconsistencies in the changes in the SEP in the qigong state is explained by the fact that the active state of different regions of the cerebral cortex in the qigong state is different, and the meaning of these changes is still worth delving into further. Bafuluofu, in a conditioned reflex study pointed out that when attention is concentrated on a certain area, in a representative region of the cerebral cortex it is possible to produce a dominance of excitement, and to maintain a the excitement level of a certain region of the cerebral cortex, this excitement can, through a negative guide and put the other regions of the cortex in a restrained state. This could be a condition the qigong practitioner in the "yishou" condition, who would be able to enter quiescence and produce the objective effect of "seeing and not seeing, hearing and not listening."

This test used the SEP to observe certain changes in the qigong state, and shows that under the qigong state, the cerebral cortex has both an easing effect and also has a restraining effect, and has supplied some clues for further discussion of the qigong state cerebral cortex mechanism conditions. But at the same time it has also shown that these changes can be the state of a single practitioner, and such factors as mental activity and the exercise method, etc. are closely related processes. As for the clear significance of these changes, much research and discussion remains to be done.



Multiple Information Processing of an EEG in the  
Qigong State

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and XIA Langyan (Institute of Chinese Medicine)

I. Summary

Chinese medical theory has long stated that "all *qi* (i.e. air, vital energy) originates from the brain;" when they practice qigong, qigong masters are always keenly aware of the control of the brain. Concentration, controlled breathing, and *yishou* (regulation of mind), *tiaoxi* (regulation of respiration), *rujing* (attainment of tranquility or quiescence) cannot be achieved without the function of the central nervous system. Therefore, from the perspective of neural science, to use the technology to measure brain functions and research the brain waves in the state of qigong to find out the characteristics of brain activity during qigong is significant and important to the understanding of the mechanisms of qigong.

Nowadays, though the technology of measuring brain waves is advanced, it remains a complex problem to analyze brain waves and extract significant information from it. This is because: 1. Brain waves are a non-stable and random electric signal; it is difficult to obtain accurate information directly from the time domain waveform. Most of the data must go through statistical analysis. One of the current and common methods is analyzing the diagram (map) by using the FFT periodic mapping approximation method. But many commonly used methods, including the periodic mapping approximation method, require that the data being processed is a stable ergodic random time series. Because of the different requirements in the processing method and the data to be processed, the result of the process differs much from the actual situation. 2. The relationships between various physiological phenomena and their manifestations in the brain are very complex. In the case of qigong, such manifestation not only varies in terms of participants and time, but depending on the location where an electronic brain signals is taken, its rhythm and intensity also vary. This shows that brain activities are multi-dimensional and random. 3. Experiments demonstrate that pathological, physiological, psychological and other environmental factors all affect the generation of brain waves; controlling and understanding the effect and changes of these factors is crucial to obtaining accurate information on brain activity. 4. In most situations, such as during the qigong *fagong* (initial stage of qigong, generating energy) phase, the distribution of brain wave current changes rapidly with time. But it is rather difficult to factor such dynamic information.

Based on the above, we believe that if our research is restricted to proving whether brain waves vary during qigong and thereby demonstrating the objective nature of qigong, the currently commonly used method of single guide EEG periodic mapping analysis should suffice. But if we intend to further factor the physiological characteristics of brain activities during qigong and study the mechanisms of qigong, we cannot make any further progress using the afore-mentioned method. For this reason, we introduce the concept of



"processing multiple information of the brain waves in the state of qigong." Its precise implication can be interpreted as using multiple methods of processing information to factor relatively complete information on the physiology of the brain through multi-levels, and multi-positions in the domains of time, frequency and space.

## II. The Content and Basis of Multiple Information EEG Processing in the Qigong State

In neuro-physiological studies, a widely used method is to observe the response of the induced brain wave through external stimulation; because every electric potential (EP), in correspondence to its stimulation, reacts in a certain way, this makes it convenient to study brain functions and their characteristics. But the premise of factoring EP is to filter out the spontaneously generated EEG, thereby losing all of the "spontaneously generated" brain wave signals. For this purpose, the German brain specialist E. Basar introduced the concept of the EEG-Epogram, which is obviously useful to the factoring of brain wave signals, but it is yet to be widely adapted due to some application problems.

By multiple information processing we refer to the following:

1. Under various stimulations of sound, light, and electricity, the comparative analyses of the variation of EP during the qigong entering quiescence phase.
2. Under different stimulations, the comparative analyses of the single guide EEG variation and EP variation during the qigong entering quiescence phase.
3. Analysis of the double conductor (left, right, front, and back in various combinations) and its correlation to EEG during the process of qigong entering quiescence phase.
4. Analysis of the multi-guide EEG spacial TOPO Fig. during the qigong entering quiescence phase.
5. Analysis of the changes of the parameter of EEG to time during the qigong entering quiescence phase.

Afterward, another round of comprehensive processing of the above results is done.

In order to insure the accuracy of the obtained information, one must pay special attention to: 1. the selection of subjects; 2. improvements of the processing method, such as enhancing the resolution and solving the problem of instability.

## III. The Study of Qigong Using the Concept of Multiple Information Processing

Our purpose was to study the brain wave activity during the qigong entering quiescence phase; we used safe (non-damaging) brain function measuring technology, systematically applied it to ordinary people, beginning qigong learners, qigong masters and other types of participants, and conducted

trial measuring of the "spontaneously generated" and induced brain wave responses. After computerized analysis, and observing the changes in the brain wave signal before and after qigong, we drew out significant characteristics. Tests completed include: body stimulation evoked potential (8 cases), auditory dermic evoked potential (6 cases), auditory brain stem evoked potential (6 cases), vision evoked potential (30 cases), EEG power spectrum analysis under sound stimulation (6 cases), and EEG power spectrum analysis under light stimulation (30 cases). In addition, our project partner, Zhang Jianzhou, of the Beijing Research Institute of Chinese Medicine, analyzed the twelve-guide EEG power spectrum diagrams during qigong and other electrical potential diagrams (7 cases); Professor Liu Guolong, of the Institute of Chinese Medicine, conducted analyses on the four-guide EEG average power spectrum charts and compression spectrum diagrams, which were obtained from ordinary participants during *waigong* (receiving qigong treatment). Some characteristics of brain wave activity during the qigong quiescence process is obtained and proven.

#### IV. Discussion of the Results

1. Through comparative studies of results of brain wave activity obtained through various method, during qigong, the "a" peak appears to intensify and centralize from the occipital to the frontal lobe area around the head. In the occipital area, the "a" peak usually does not show any significant change; a few cases slightly show a tendency to decrease. This was first reported by Mei Lei in 1981, and it was proven later on in our experiments as well as in the experiments conducted by other participating units. (See Figs. 1, 2, 8, and 9).

The frontal lobe area is an important area for the activity of human consciousness; currently, "the a" frequency is normally considered to be clearly tied to the lower hypothalamus area this area is the key to its generation. The appearance of the dominant "a" peak may reflect the linking up of the lower hypothalamus and the frontal bone areas during qigong. It may be assumed that normally the "a" wave of the occipital area is dominant in the external systems, and a person is in an open state to the outside world. During qigong, the frontal bone, hypothalamus, and lower hypothalamus areas are linked up, "a" waves appear dominant in the frontal bone area; the brain hence increases its control over the body. Perhaps it is the intensified control over the voluntary regulation of the body's organs and excretion glands which contributes to the preservation and care of one's health.

2. During qigong, the dermic area of the brain, having lowered its response capacity to external stimulation, is in a state of general inhibition. As is shown by evoked response through various stimulations, electric potential (EP) is being inhibited to varying degrees. Fig. 4 shows the inhibited body response to stimulation during qigong entering quiescence phase. Fig. 5 shows the inhibited auditory dermic response to excitation. Fig. 7 shows that vision evoked response is also inhibited. These results perhaps confirm the objectivity of the claim that during qigong, one may experience "no hearing, no seeing, and no thinking."

3. Auditory brain stem evoked potential has roughly more than seven multi-phase waves within 10ms, which come from the various levels of the brain

stem. During qigong, some of the elements are in an easing state, see Fig. 6, which reflects the complexity of the entire body dynamics during qigong. This result may indicate that during qigong, the body's response to external stimulation is suppressed while the body intensifies its internal self-control and self-regulation.

4. The figures of repeated electric potential (EP) (See Fig. 4) and EEG time and spacial distribution (the compression spectrum Fig. and TOPO Fig.) show that the stability of time, and the consistency and symmetry of space have all been improved. To a certain extent, this shows that the neural activity is better regulated.

5. The sleep phase is different from that of qigong: 1) Fig. 3 shows that under sound stimulation during sleep phase, the "a" peak of EEG disappears; 2) An article reported that during the sleep phase, the dermic response to excitation is evidently enhanced; but during the qigong entering quiescence state, the dermic response to stimulation is suppressed; the responses of the two are opposite. 3) After a qigong practice, the dermic evoked potential shows an obvious post suppression effect, which is also different from the situation with the sleep phase. Of course, the above results are far from enough, further distinction and analysis is necessary.

6. The brain waves of ordinary subjects who do not practice qigong, during *waigong*, show similar changing patterns as the brain waves of those who practice qigong, which is a phenomenon worth further observation and investigation (See Figs. 8 and 9); it may help explain the mechanisms of healing through *waigong*.

Up till now, our work has been still fairly experimental. All we have done is to use strictly scientific methods to confirm phenomena already known, we have yet to touch the unknown areas. This entire field requires more in-depth study.

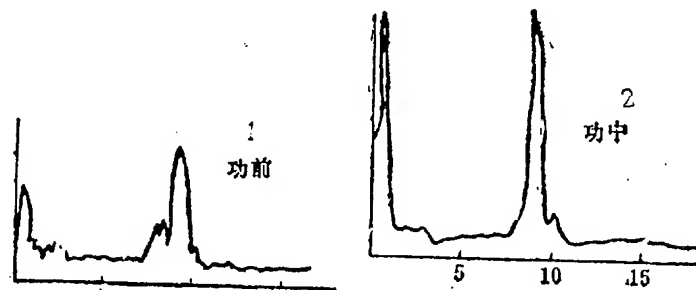


Fig. 1 EEG power spectrum Fig. of the dermic response under sound stimulation.

1. Before qigong
2. During qigong

Fig. 2 EEG power spectrum Fig. of the occipital area under light flare stimulation.

1. Before qigong      2. After qigong

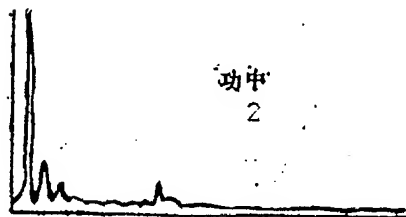
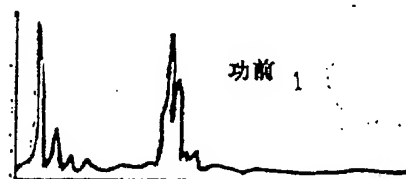


Fig. 3 EEG power spectrum Fig. of the temporal bone area during sleep during sound stimulation.

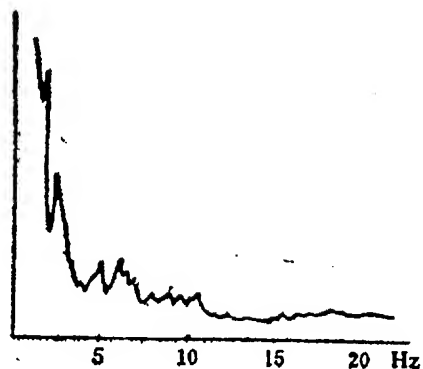


Fig. 4 Somatosensory evoked potential.

1. Before qigong
2. During qigong
3. After qigong, 15 minutes
4. After qigong, 25 minutes

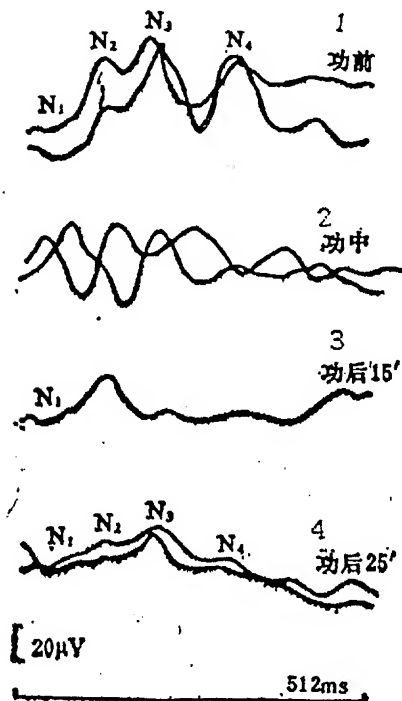
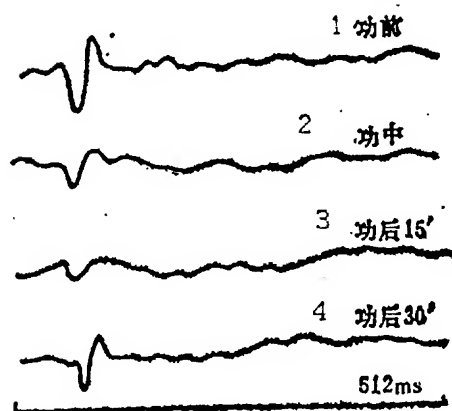


Fig. 5. Auditory dermic evoked potential.

1. Before qigong
2. During qigong
3. 15 minutes after qigong
4. 30 minutes after qigong



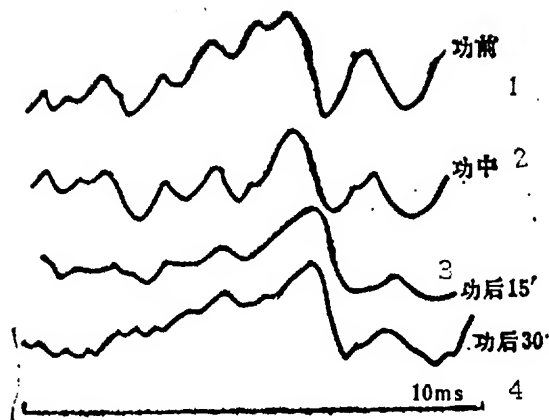


Fig. 6. Auditory brain stem evoked potential.

1. Before qigong
2. During qigong
3. 15 minutes after qigong
4. 30 minutes after qigong

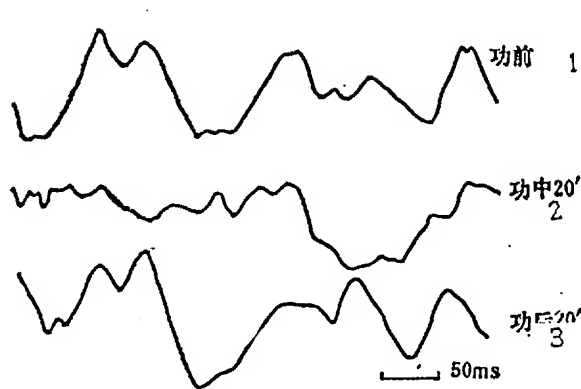


Fig. 7 Vision evoked potential under light flare.

1. Before Qigong
2. During Qigong 20 minutes
3. After Qigong 20 minutes

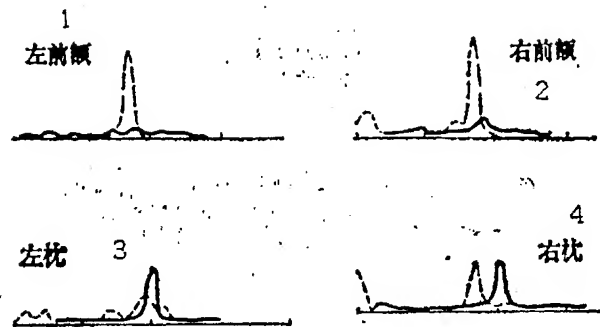


Fig. 8 EEG Average power diagram  
(Solid line: Before qigong; Dotted line: During qigong)

1. Left frontal bone
2. Right frontal bone
3. Left occipital
4. Right occipital

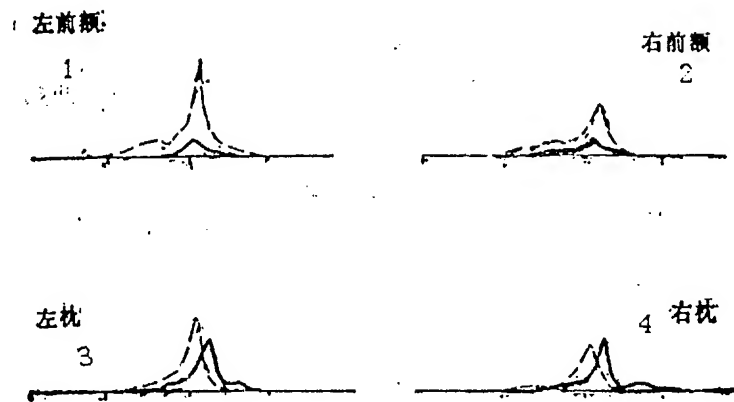


Fig. 9 EEG average power Fig. of ordinary participant receiving qigong treatment.  
(Solid line: Without receiving qigong treatment; Dotted line: during qigong treatment)

1. Left frontal bone
2. Right frontal bone
3. Left occipital
4. Right occipital

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The Function of an AR Model in Extracting  
Brain Wave Characteristics in the Superquiescent State

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I. Introduction

Chinese qigong has a long history; it has many schools of practice and its influence has spread far and wide. Over the years, qigong has contributed to the development of human wisdom and the enhancement of people's health. It is an awesome blossom of the flower of civilization of our country. The purpose of qigong practice is to integrate and coordinate a person's body with his mind, so that the person's soul and qi (vital elements) mutually complement. Qigong focuses on the controlling of xin (the mind), and concentrates on the training of the brain and training of one's consciousness. The exercise works on both the body and the mind so as to develop both. In his article, Hu Zhongyi<sup>[1]</sup> introduced the concept of modern qigong, which divides the process of modern qigong into four basic states: the super quiescent state (or super tranquil state), the super dynamic state, the super sensuous state, and the super energy state. Among them, the super quiescent differs from ordinary the quiescent state, because the person doing qigong basically is free of the external disturbance and internal noise and enters into a state of extreme tranquility. Currently the results of much measuring and testing of the quiescent (tranquil) state of qigong in this country have demonstrated that in the state of deep quiescence (tranquility), many positive indexes appear, such as the reduction in the consumption of air, the reduction in the amount of air breathed in each time, the slowing of breathing, lowering of blood lactic acid, slowdown of the heartbeat rate, the increase in brain wave regularity; and many other signs. These indexes indicate that during the quiescent period of qigong, the brain has an effect over the entire body to make it stay in a recuperative state of low metabolism, while the synchronicity of brain waves coordinates the body and mind. All of this indicates the well-being of a person. Hence the super quiescent state is considered the basis of modern qigong.

There has been progress in research on the super quiescent state, but the differences between human bodies make the question complex and difficult. As of yet, no common characteristics of the super quiescent state have been found, and understanding of this state is far from adequate. Since the super quiescent state differs from ordinary quiescent state, and various states all have their distinctive characteristics, there must be certain inherent common characteristics during the super quiescent state, regardless of the differences between the human body. It is worthwhile to find the common characteristics through differentiating the super quiescent state and the ordinary quiescent state. This will aid in finding a new angle for research on super quiescent state and help us further understand the super quiescent state and provide a new method for the application of biological feedback.

Due to the dominant role of the human consciousness during the phase of entering the super quiescent state, and the fact that the frontal bone area is, in terms of evolution, the newest formed area of the head, the frontal

area, being the transitional point from a neural process to consciousness, is an important area of human consciousness. Therefore, to start with brain wave signals from the frontal area to differentiate the ordinary quiescent state from the super quiescent state, it is possible to identify common characteristics during the super quiescent state. At the same time, the time series AR model is a good method for extracting characteristics, and it is a convenient method to use. It can also be used to study the dynamic change in brain waves when a person enters the super quiescent state from the ordinary quiescent state.

## II. The Drifting of the Base Line of Brain Wave Signals and the Elimination of Disturbances from a 50Hz Power Supply<sup>[2]</sup>

The characteristics of brain waves are that they are small signals, high in noise, and among the brain wave signals there are false signals mixed in. Therefore, the first step in computerized automatic analysis of brain waves is to eliminate false signals. But the most common false signals are the drifting of the base line and disturbances from 50Hz power supplies<sup>[3]</sup>, which are inevitable. Yet if false signals are not eliminated, they will eventually be reflected in the model, causing the model to be unable to grasp the real brain wave signals. The consequences will be a failure to extract any characteristics or even the generation of a wrong conclusion. For this reason, we adopted the method of digital noise filtering to eliminate these two kinds of false signals, taking into consideration the requirements over these filters. The internal lines of the passband are small. It has a large decreasing rejection and linear phase position. Therefore, we selected a digital non-recursive finite impact response noise filter (NRFIR)<sup>[4]</sup>.

### 1. Method of elimination.

$$y(nT) = \sum_{i=0}^{N-1} x((n-i)T) \cdot h(iT) \quad (1)$$

In this formula, T is the sampling interval, T=0.01s

- y(nT) Sampling of output signals
- x(nT) Sampling of input signals
- h(iT) Coefficient of finite impact response noise filter.
- N Length of sampling in noise filter.

Through the convolution of input signals with the impact response, the frequency spectrum of output signals becomes their product. Considering the drifting of the EEG base line and the range of EEG frequencies, using a bandpass noise filter, the ideal filtration frequency is shown in Fig. 1,  $f_k$  and is the cut-off for low frequencies. In addition, around 50Hz, a very narrow band can be seen, for eliminating the disturbance from industrial frequency power supplies. When selecting  $f_k$ , one must consider the importance of the low frequency area of the brain wave signals and the drift of the base

line, and try to prevent false signals from mixing into the model without losing important information. For this reason, we select  $f_k=1.10\text{Hz}$ .

Using a Fourier series, after truncation, shifting, adding a window and other mathematical processing, one can obtain the impact response coefficient which fulfills the specific frequency requirement. For a detailed derivation, see [22].

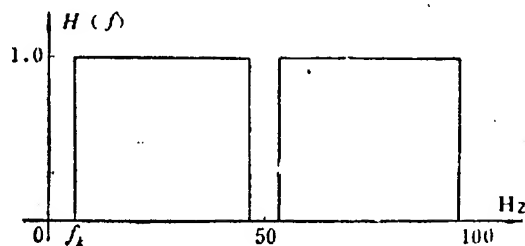


Fig. 1

## 2. Results of pre-processing

We apply the designed noise filter to the pre-processing of the actual brain wave signals. In Fig. 2, a is the sampling of brain wave signals of a subject, the sampling time is 2.5 seconds; b is the brain wave signal after noise filtration, c is the filtered base fluctuation element and the disturbance of 50Hz industrial frequency power supply. One can see that the noise filter effectively eliminates these two kinds of false signals, demonstrating its effectiveness.

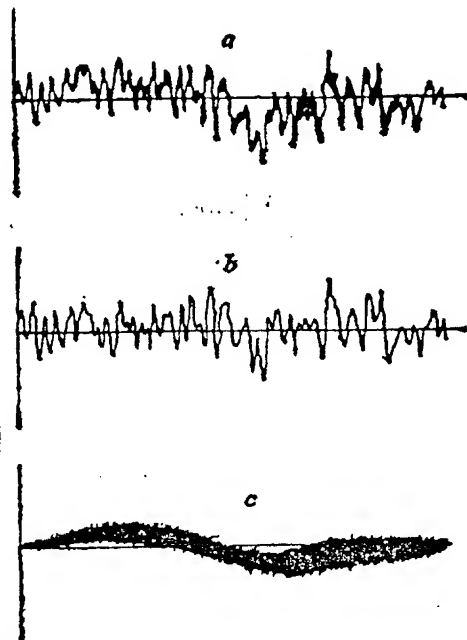


Fig. 2

### III. The Principles of the AR Model and an Estimate of Parameters

In recent years, with research on random signals, a method has been developed to establish parameter models for the random signals for the smallest mean square error; in particular, this is the automatic return model (AR). Because it takes easy computation to set up, it is fast and is effective, it is widely used in bio-medical signal research, speech sound differentiation, oil prospecting and other fields. Besides being used for spectrum estimation, the AR model is also used for data compression, extracting of characteristics, and others.

The reasons for adopting the AR model for brain wave analysis are as follows:

- 1) Any stable time series can be described by the AR model<sup>[5]</sup>.
- 2) Overall, brain waves are neither linear, nor stable. But within a short interval, brain waves can be considered as stable and linear.
- 3) When the signals are of a Gaussian type, AR models are the best; otherwise, linearity is the best. Within a short period of time brain waves are very close to Gaussian process<sup>[6]</sup>, therefore the AR model is closest to the best.

The block diagram for the automatic return process is shown in Fig. 3.

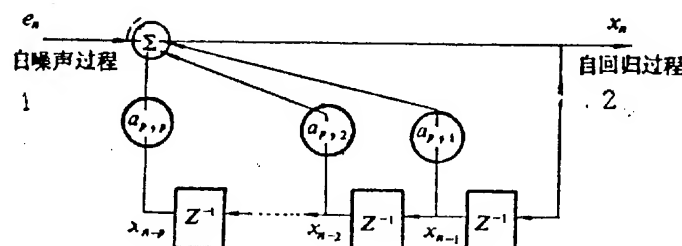


Fig. 3

1. White noise
2. Automatic return process

$$x_n = - \sum_{i=1}^p a_{p,i} x_{n-i} + e_n \quad (2)$$

In this formula,  $a_{p,i}$ ,  $i=1, \dots, p$  is the parameter for AR model of  $p$  order

$p$  is the scale of the model;

$e_n$  is the input white noise, also called estimate error.

Do a  $z$  transform on both sides of formula (2), then

$$\frac{X(z)}{E(z)} = \frac{1}{1 + \sum_{i=1}^p a_{p,i} z^{-i}}$$

In this formula,  $X(z)$ ,  $E(z)$  are the  $z$  transforms for  $x_n, e_n$ ; from the above formula, and one can see that the AR model has only poles, which gives it the name, all pole model; the poles are on a plane surface, which reflects the degree of the stability of the system. This is an important piece of information in model analysis.

The key for solving the AR technical problem is the method used to estimate the parameters for the AR model. The exchange method has three requirements: 1) it requires consistency of the estimates of parameters; 2) fast speed; 3) the calculation method must be recursive. Currently, though there are many calculation methods, of which the Marple method is one of the relatively effective ones. This method is established on the basis of the method of estimating the unconstrained smallest square of the AR parameter. Therefore, it is more effective than the commonly used Burg computation method. The amount of its computation can be compared with the Burg method. For details of the derivation using the Marple calculation method see [7].

The selection of the scale of the AR model is not only related to the nature of the signals, but also to the purpose of our research. Our purpose is to introduce two principles for selecting the model scale, based on the extracting of the characteristics of the super quiescent state. The first one is that a reasonable order number for the model can aid the AR model in fully grasping the important information (the main consideration being the estimate of the power spectrum). The second is to adhere to the frugality principle inherent in the theories of model building in the selection of model scale.

Fig. 4 is the estimate of power spectrum under various model scale numbers. The scale numbers are 7, 9, 13 and 15. A large quantity of experimentation has shown that when  $p$  is scale number 9 and above, the shapes of the spectrum estimate are more or less the same, which is what we call basically grasping the important brain wave information. According the Principle 2, we selected the model scale  $p = 9$ .

Considering the stability and Gaussian characteristics of the brain waves within short periods of time, the selected data length  $N=256$ , and the short time process is 2.56.

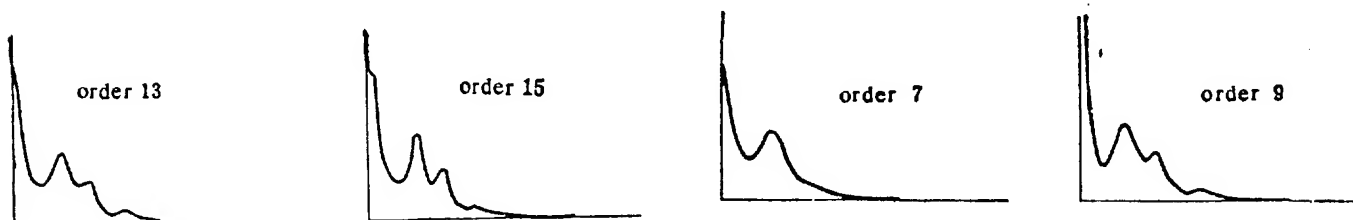


Fig. 4

#### IV. Differentiation Analysis

Based on the available data, the categorization of research subjects is a problem of differentiation. It is the formation of one or one group of functions. Using available information, one determines the coefficient of the differentiation function as well as the differentiation index to decide which individual belongs to which category. Our purpose is to start with brain wave analysis to differentiate the super quiescent state and ordinary quiescent state. The characteristics of the states are extracted through the AR model and forming the AR coefficient form vector

$$\bar{A} = [a_1, a_2, \dots, a_p]^T$$

This is considered as the vector which describes the brain wave state. Because  $A$  is the dimension of  $p$ , and  $p$  is usually large, this means there are many variables in the differentiation analysis. Therefore to establish a differentiation function requires a lot of computation, and when the independent variable is not independent, it can lower the accuracy of the computation of the inverse matrix, and a pathological condition may appear. Therefore, the differentiation function derived from it is not stable, its differentiation capacity is low. Hence, it is important to select important variables among the variables rendered for differentiation categorization. The method of step-by-step differentiation is an appropriate method to accomplish this task.

Suppose  $W = (W_{ij})$ ,  $T = (t_{ij})$ , respectively, are the inner group and total dispersion matrix which are formed by  $p$  number of selectable variables  $a_1, a_2, \dots, a_p$ .

$$\lambda = \frac{|W|}{|T|}$$

is the Weierkosi statistic, which indicates the differentiation capacity of these variables; the smaller  $\lambda$  is, the lower is its differentiation capacity. The  $F$  testing method can be used to determine the contribution of the  $x$ th variable.

$$F(G-1, N-G-m) = \frac{W_{xx}^{(m)} - W_{xx}^{(m-1)}}{W_{xx}^{(m-1)}} \cdot \frac{N-G-m}{G-1} \quad (3)$$

In it,  $G$  is category number;  $N$  the sampling number;  $m$  is the variable number. In the step-by-step differentiation  $m$  is the step number; the  $m$  in superscript indicates the  $m$  number of the Gaussian elimination method.

Step-by-step differentiation includes two processes. (1) The process of selecting variables. (2) Establishing the differentiation function.

(1) During the selection of variables, each step selects the best variable to test. If this selected variable is significant, then examine whether this newly added variable causes significant changes in the previously

selected variables, so as to promptly eliminate those variables that cannot contribute additional information, until there is no more selection and no more elimination; finally, examine the additional information of those unselected variables; if it is not obvious, the selection process is over; otherwise, select the variable that makes  $\Delta$  the smallest, until the variables left cannot contribute additional information.

(2) Establish the differentiation function, the Baersi pure function under normal state parent substance is

$$Y_j = \ln q_j + C_0 j + C_1 j a_1 + \dots + C_p j a_p$$

$$j = 1, 2, \dots, G$$

In the formula  $q_j$  is a pre-test probability; when the differences between various order numbers are not great, this item is usually omitted, and the formula becomes

$$Y_j = C_0 j + C_1 j a_1 + C_2 j a_2 + \dots + C_p j a_p$$

(4)

In the formula,  $C_{ij}$  is the differentiation coefficient for the unselected variable  $i$ , there is  $C_{ij} = 0$

Compare  $Y_j$  of each type, select the largest to be this type.

$$Y_j^* = \max(Y_j)$$

$$Y_j^* = \max_{1 \leq j \leq G} (Y_j)$$

(5)

## V. Clinical Testing Results

We conducted and recorded clinical brain wave testing in the brain wave testing lab that we designed. The subjects were divided into two groups, with ages ranging from 25 to 60. The first group was a control group, consisting of twelve people, all of whom do not practice qigong. The second group was qigong group, which is made up of 8 subjects, all of whom have practiced qigong for over three years, and who can basically be free of external disturbance and internal noise and achieve fairly good quiescence. During the test, each member of the qigong group had their brain waves recorded for 40 minutes, including 5 minutes before qigong, 30 minutes during qigong, and 5 minutes after qigong. The control group is asked to imitate the qigong group for the test, but the testing time is shorter, about 30 minutes. The off-line analysis of the brain waves of the frontal bone area is in a block diagram shown in Fig. 5.

In the diagram, the function of the low-pass filter is to prevent the effect of frequency mixing during sampling. The sampling frequency is 100Hz and the cut-off frequency of the noise filter is 50Hz. Signal pre-processing

refers to the elimination of the drift of the base line in the brain wave signals and the disturbance from the 50Hz power supply. The analysis of the results includes analysis of the power spectrum, differentiation analysis and others. The results are as follows.

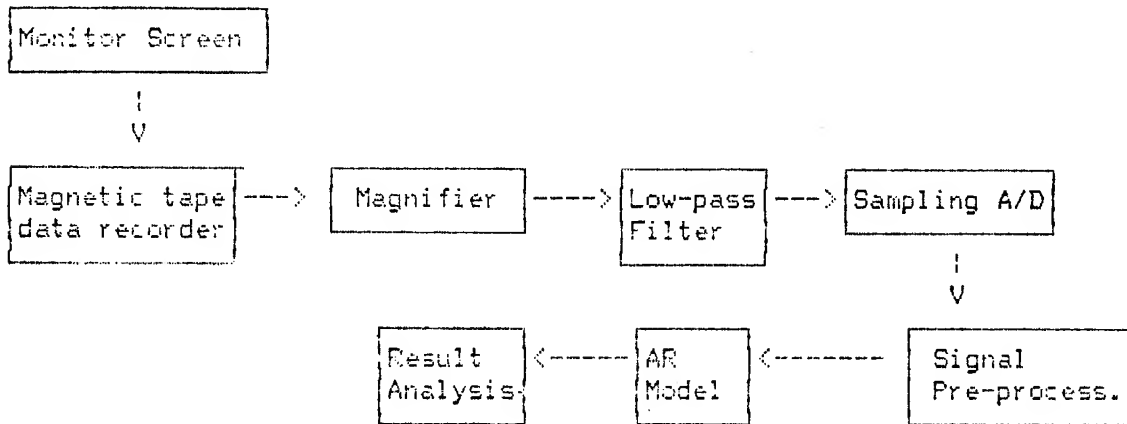


Fig. 5

# 1. EEG power spectrum map

(a) Qigong group. Figs. 6 to 9 are EEG power spectrum maps of the qigong group (not including after qigong) (all refer to frontal bone area EEGs).

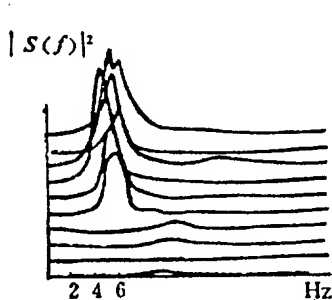


Fig. 6

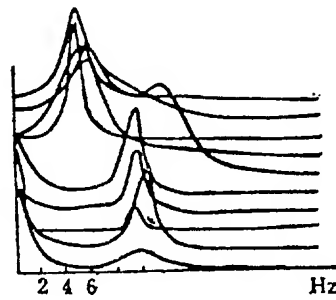


Fig. 7



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Subject: Zhu XX

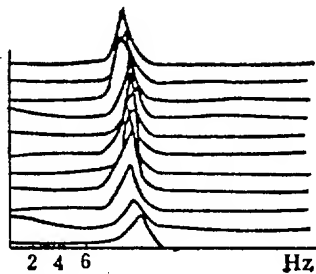


Fig. 8  
Subject: Wu XX

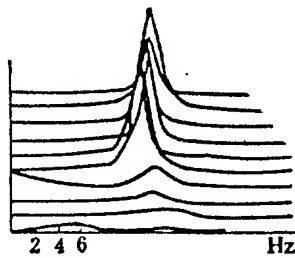


Fig. 9:  
Subject: Hu XX

From the Figs., one can see that before qigong, the  $\alpha$  wave basically is dominant. The range of the EEGs is the same as that of an ordinary person. As qigong progresses (deepens) into the super quiescent state, the range increases greatly. The greatest increase reaches to over ten times larger than before qigong, and two phenomena appear: 1. The EEGs of the frontal bone area shows a great concentration of the  $\theta$  wave power, the smallest frequency is 6.08Hz. That is, from the  $\alpha$  peak to the  $\theta$  wave peak, the biggest frequency shift reaches 4.70Hz, as shown in Figs. 6 and 7. 2. The concentration of  $\alpha$  waves, and the frequency of  $\alpha$  wave peak shifts downward, as in Fig. 8, from 10.2Hz to 8.6Hz, and in Fig. 9, from 12.1Hz to 10.94Hz.

(b) The results from the control group are shown in Figs. 10 and 11. Neither phenomenon 1 nor 2 appeared, and neither is it seen that the range of the EEGs is enlarged.

## 2. The Results of Differentiation Analysis

We use the characteristic vector formed by AR coefficient for differentiation analysis. The sampling dimension  $m=9$ ; 25 samples are taken of the control group during the imitation qigong ( $n_1=25$ ); 20 samples are taken of the qigong group during the super quiescent state ( $n_2=20$ ), mean value checking and measuring is conducted to two parent substances (i.e. checking and measuring the differentiation result), and Hotelling's  $T^2$  statistics is converted into  $F$  statistics for the test<sup>[8]</sup>; the results are as follows:

$$T^2(n_1+n_2-2)=0.36472, F(3,35)=15.683$$

But  $F_{0.05}(9,35)=2.17$ ,  $F > F_{\alpha}$ , differentiation result is significant. When doing a step-by-step differentiation, take  $F_{\alpha}$  as the input variable to use for adjusting the selected variables to improve their differentiation result. The result: the selected variables are  $a_1$  and  $a_2$ ; two special differentiation functions are:

$$Y1 = -9.4635 + 17.3556a_1 + 9.0423a_2$$

$$Y2 = -28.1917 + 29.9589a_2 + 21.4446a_3$$

The principle of differentiation If  $Y1 > Y2$ , it is determined to be Group 1 (control group); otherwise, it is Group 2 (qigong group).

Using the obtained function to re-determine the original 45 samples, and the result is shown in Fig. 1. We can also obtain the range for these two groups of parameters  $a_2$ ,  $a_3$ , as shown in Fig. 12. The dotted line in the Fig. is the dividing line, I and II each represent Group 1 and Group 2.

We also conducted brain wave tests on Group 3 and Group 4 in the Jiangong Hospital of Zhejiang Province. The subjects had practiced qigong for about half a year, and their ability to achieve quiescence is about average. There were 10 subjects total, and 20 samples were taken during qigong. We used the step-by-step differentiation method on Group 1 and 3, Group 2 and 3 to determine the two basic groups. As before, the range of the parameters can be mapped out, as shown in Fig. 13 and 14.

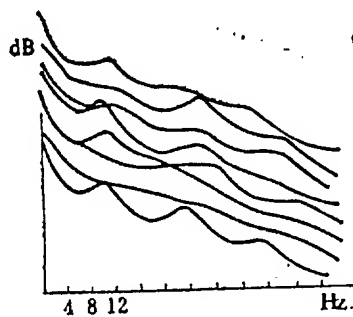


Fig. 10  
Subject: Wu XX

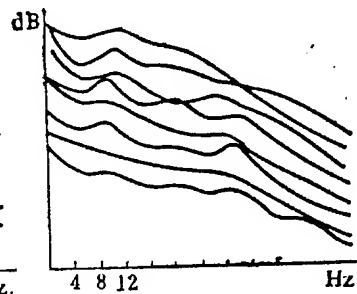


Fig. 11  
Subject: Ying XX

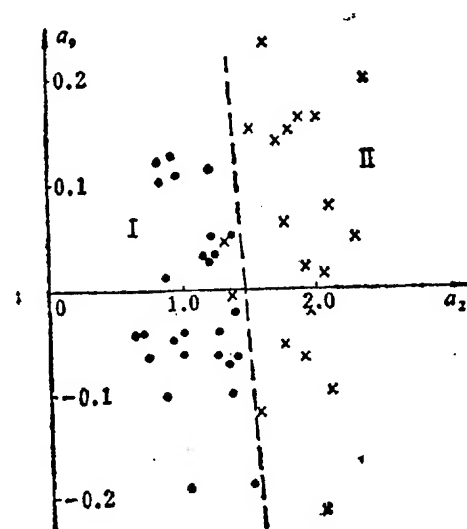


Fig. 12

Table 1

I	Y1		Y2	Original Category	Differentiation Category
1	5.896	-.976	1	1	
2	8.222	2.966	1	1	
3	11.353	7.869	1	1	
4	12.173	9.415	1	1	
5	6.857	-1.174	1	1	
6	7.258	.298	1	1	
7	14.410	12.871	1	1	
8	11.784	8.101	1	1	
9	15.269	13.357	1	1	
10	12.186	8.931	1	1	
11	7.806	1.372	1	1	
12	13.275	10.630	1	1	
13	14.443	12.669	1	1	
14	11.349	7.869	1	1	
15	13.367	10.605	1	1	
16	12.044	9.098	1	1	
17	14.729	13.837	1	1	
18	12.405	10.197	1	1	
19	2.403	-7.973	1	1	
20	2.833	-7.378	1	1	
21	5.012	-3.797	1	1	
22	6.187	-1.476	1	1	
23	7.862	2.439	1	1	
24	5.914	-1.033	1	1	
25	1.551	-9.450	1	1	
26	24.582	31.497	1	1	
27	31.775	24.061	2	2	
28	27.263	35.614	2	2	
29	21.669	25.877	2	2	
30	14.235	12.645	2	2	
31	13.918	12.391	2	2	
32	23.362	29.317	2	2	
33	21.296	25.682	2	2	
34	26.745	35.194	2	2	
35	20.701	25.374	2	2	
36	20.164	22.595	2	2	
37	22.950	27.327	2	2	
38	23.948	29.566	2	2	

39	20.046	22.025	2	2
40	30.355	40.770	2	2
41	26.119	33.268	2	2
42	18.076	20.155	2	2
43	26.069	32.495	2	2
44	24.526	30.332	2	2
45	24.284	28.757	2	2

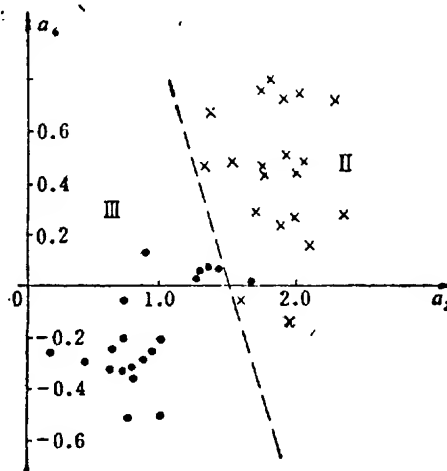


Fig. 13

Based on discrimination of two basic groups, we differentiate Group 1, 2, 3 as the three basic groups. We used the obtained differentiation function to differentiate the state of Bao XX's (of the qigong group) entire qigong process. The result is shown in Table 2. One can see that before and after qigong the brain waves and that of the control group are no different. When s/he does achieve quiescence, s/he appears to be in super quiescent state; from ordinary quiescent state and super quiescent state, or from super quiescent state back into ordinary quiescent state, there appears a transitional state like the middle group. These results are fairly accurate.

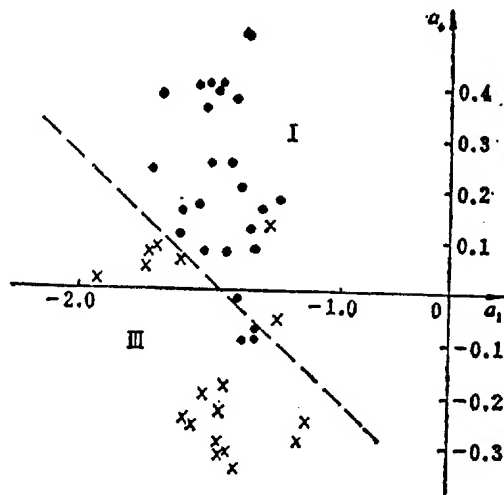


Fig. 14.

## VI. Conclusion

1. In the super quiescent state and ordinary quiescent state, there are great differences in the brain waves of the frontal bone area. In the super quiescent state, the brain wave power spectrum increases greatly, the frequency of the spectral peak decreases, the largest shift of the spectral peak reaches 4.70Hz, which is a shift from the dominant a before qigong to the great power concentration of the  $\theta$  wave. Results of initial experiments show that the degree of shift of the spectrum peak is in positive correlation to the degree of entering quiescence.

2. The AR model effectively grasps the characteristic information of brain waves. Results of differentiation show: in the AR model, various states have a similar parameter range.

Table 2

I	$Y_1$	$Y_2$	$Y_3$	DISCRIMINATION
1	62.82767	61.83720	61.38614	1
2	57.67648	54.13518	57.87144	3
3	54.77847	51.11292	54.86907	3
4	58.32027	55.49109	57.69641	1
5	90.86197	94.70979	85.08024	2
6	98.51144	103.99873	94.03935	2
7	94.02859	101.26982	89.09328	2
8	75.62760	79.75772	71.25853	2
9	99.91814	103.42058	98.23941	2
10	86.46051	96.94255	78.87012	2
11	40.73705	34.46613	37.38629	1
12	49.10265	47.63732	48.49743	1
13	47.22195	44.21285	46.87376	1
14	62.85606	59.37024	58.71066	1 STOP

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## EEG Coherence and Topography in the State of Superquiescence

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### Summary

This article will deal with an electroencephalogram (EEG) analytical method used for studying the superquiescent state, and explain the significance of the superquiescent state cerebral region EEG coherence function. Debugging of the EEG coherence analysis, the EEG power spectrum topographical analysis and the EEG coherence topographical analysis programs was completed on an Apple-II minicomputer, and after 30 test analyses it was revealed that under the superquiescent state:

(1) There is a distinct rise in the cerebral EEG coherence index;

(2) The amplitude of the EEG increases rapidly, while energy is transferred from the back of the cerebrum to the front;

(3) The dominant frequency of the EEG is reduced.

Finally, we will conduct a discussion about indices involved in entering superquiescence and propose the concept of the superquiescence level.

### 1. Introduction

The superquiescent state is one of man's special psychological conditions, and with China's Qigong and India's yoga, as well as Transcendental Meditation (TM), it is possible, through training, to make a person basically separate himself from outside disturbances and inner noise, and make the cerebral cortex enter into protective inhibition, thereby entering into the superquiescent state. In the superquiescent state, a series of changes occur in a person's mental state and psychological indices, and a number of beneficial indices emerge.

Research both within China and abroad<sup>[1-3]</sup> indicates that in the process of entering superquiescence, distinct changes occur in EEG indices. With a normal person in a sober state, a large number of high frequencies are recorded, along with low amplitude random waves, the harmonics are very small, and EEG synchronism concentrated in each region of the top of the head is quite lacking. After entering the superquiescent state, a large number of low-frequency harmonics in the brain waves are seen, first emerging in the occipital lobe, and then shifting towards the forehead region. The other special characteristic of EEG change is the tendency of EEG activity in each region towards synchronism. The physical training of Qigong, yoga, and TM not only orders brain cell electrical activity, but also greatly increases the intensity of the ordered activity. In addition, the

better the degree to which this state is entered, the more distinct the synchronism of the EEG. For this reason, we use the degree of synchronism between two EEG signals, called the coherence function, which describes the improved condition of cerebral ordering in the process of entering the superquiescent state. The cerebral forehead region, which is a product of the high degree of evolution of the human species, is responsible for conscious activity, and the cerebral forehead region EEG coherence function is able to act not only as a measure of the harmonized synchronism of cerebral cortex activity, but is also related to the high level functions of the cerebrum. Data indicates<sup>[57-59]</sup> that there is a close link between the cerebral forehead region EEG coherence function and human intelligence and creativity, when the correlation coefficient reaches 0.60, ( $p < 0.001$ ). For two single frequency sine signals, when their coherence function value in a certain frequency position is greater than 0.95, we can consider that the two signals are completely synchronous<sup>[11]</sup>. For this reason, we select the coherence index of the cerebral forehead region's two EEG signals as the frequency component of the coherence function value between the two signals within the overall EEG frequency range which exceeds 0.95. In the process of entering the superquiescent state, studies of the cerebrum forehead region EEG coherence indices are of extreme significance.

Brain Electrical Activity Mapping (BEAM) is a major tool in clinical diagnosis. In order to investigate the spatial distribution of EEG signals when entering the superquiescent state, we have proposed an EEG power spectrum mapping analysis technique, using an examination of the overall spectrum of the EEG or the EEG power spectrum distribution of each frequency range in practicing the changing trends of each state. On the basis of EEG coherence analysis, we have also proposed an EEG coherence mapping analysis method, in order to investigate the changing conditions of the coherence indices of each region of the cerebrum.

## 2. The Principles of Coherence Analysis and Mapping Analysis and Algorithms for Implementing Them

The coherence function is a measure of the correlation of two signals at a certain frequency, and is defined as

$$(r_{xy}(f))^2 = \frac{|S_{xy}(f)|^2}{S_x(f) \cdot S_y(f)} \quad 0 \leq (r_{xy}(f))^2 \leq 1 \quad (1)$$

where  $S_{xy}(f)$  represents the mutual power spectral density of the two signals  $x(t)$  and  $y(t)$  at the frequency  $f$ ,  $S_x(f)$  and  $S_y(f)$  respectively represent the individual power spectral densities of the signals  $x(t)$  and  $y(t)$  at the frequency  $f$ . (The original article referred to the double sided power spectral density).



For the stochastic steady state processes  $x^{(P)}(t)$  and  $y^{(P)}(t)$ , the following equation holds

$$S_{xy}(f) = \lim_{T \rightarrow \infty} \frac{1}{T} E[X_p^*(f, T) Y_p(f, T)] \quad (2)$$

where  $Y_p(f, T)$  is the finite Fourier transform of the Pth time series  $y^{(P)}(t)$ ,  $T$  is the length of the series.  $X_p^*(f, T)$  is the complex conjugate of  $X_p(f, T)$ , and  $E[\cdot]$  means to seek the mathematical expectation for a random variable.

For a time discrete series, the coherence function may be written as

$$(r_{xy,k})^2 = \frac{|S_{xy,k}|^2}{S_{x,k} S_{y,k}} \quad (3)$$

where  $k$  is the  $k$ th frequency component.

After writing the calculation of the mutual power and the individual power spectral densities of the  $k$ th frequency components of the discrete series  $x_j$ ,  $y_j$  as  $S_{xy,k}$ ,  $S_{x,k}$  and  $S_{y,k}$  respectively, an approximation of the coherence function of the given frequency can be represented as

$$(\hat{r}_{xy,k})^2 = \frac{|\hat{S}_{xy,k}|^2}{\hat{S}_{x,k} \hat{S}_{y,k}} \quad (4)$$

For the estimate of the mutual power spectral density in the above equation, referring to equation (2), it is necessary to do a smoothing. There are two types of smoothing methods: frequency smoothing and the sectional method. From the point of view of calculation, it is more suitable to adopt the sectional method.

The sectional method takes a comparatively long series  $x_j$ ,  $y_j$  ( $j = 0, 1, \dots, N-1$ ) and divides it into comparatively short subseries  $x_p^*$  and  $y_p^*$  ( $l = 0, 1, \dots, N'-1$ ,  $P = 1, 2, \dots, n$ , with overlapping among each subseries permitted). For the Pth subseries, a spectral analysis is conducted to obtain the Fourier transform coefficients  $X_p(k)$ ,  $Y_p(k)$  ( $k = 0, 1, \dots, N'-1$ ) of each frequency component. The estimation of the mutual power spectral density of the  $k$ th frequency component is given as

$$\hat{S}_{xy,k} = \frac{\Delta t}{N'} \sum_{p=1}^n G_p X_p^*(k) \cdot Y_p(k) \quad (5)$$

where  $\Delta t$  is the sampling interval,  $N'$  is the length of the subseries, and  $G_p$  is a weighted series, which satisfies the equality

$$\sum_{p=1}^n G_p = 1.$$

For the individual power spectral density estimations, there are similar representations.

Normally, each  $G_p$  ( $p = 1, 2, \dots, n$ ) is chosen as equal, then we have

$$\hat{S}_{xy,k} = \frac{\Delta t}{nN'} \sum_{p=1}^n X_p^*(k) \cdot Y_p(k) \quad (6)$$

$$\hat{S}_{x,k} = \frac{\Delta t}{nN'} \sum_{p=1}^n |X_p(k)|^2 \quad (7)$$

$$\hat{S}_{y,k} = \frac{\Delta t}{nN'} \sum_{p=1}^n |Y_p(k)|^2 \quad (8)$$

In this manner, the solution to the coherence function estimation can be found using the following equation

$$(r_{xy,k})^2 = \frac{\left| \sum_{p=1}^n X_p^*(k) \cdot Y_p(k) \right|^2}{\sum_{p=1}^n |X_p(k)|^2 \cdot \sum_{p=1}^n |Y_p(k)|^2} \quad (9)$$

The definition of each parameter follows. The selection of the sampling frequency is determined by the characteristics of the signal frequency spectrum and the nature of the analyzed parameter. For spontaneous EEG signals, with a comparatively narrow frequency band, we selected a sampling frequency of 60 Hz, because our analyzed coherence index does not place any special requirements on the frequency resolving power, and we selected the subseries length  $N'$  to be 128, and selected the series length  $N$  to be 256. Now we have:

- sampling frequency  $f_0 = 60$  Hz,
- total sampling time  $t_0 = N/f_0 = 256/60 = 4.26$  s,
- the frequency resolving power  $\Delta f_0 = f_0/N' = 60/128 = 0.469$  Hz.

Two factors must be considered when selecting the smoothing number  $n$ : based on a consideration of the deviation and the variance of the coherence estimation,  $n$  should be chosen large. Considering the requirements of coherence analysis concerning the calculation speed, the requirements for  $n$  for our selected coherence index are not high (looking at the deviation and variance distribution of the coherence estimation, when the coherence function truth value is comparatively large, the deviation and variance of the estimation will be quite small), and finally, we define  $n$  to be 12.

Considering the two EEG signals  $x(t)$  and  $y(t)$ , after sampling by a frequency  $f_0$  sampling circuit, we obtain a discrete series  $x_j, y_j$  ( $j = 0, 1, \dots, 255$ ).

Then we take the total series and divide it into 12 overlapping subseries:

- series 1 ( $x_0, x_1, \dots, x_{127}; y_0, y_1, \dots, y_{127}$ )

- series 2 ( $x_{11}, x_{12}, \dots, x_{128}; y_{11}, y_{12}, \dots, y_{128}$ )

.....

- series P ( $x_{11P-11}, x_{11P-10}, \dots, x_{11P-116}; y_{11P-11}, y_{11P-10}, \dots, y_{11P-116}$ )

.....

- series 12 ( $x_{121}, x_{122}, \dots, x_{128}; y_{121}, y_{122}, \dots, y_{128}$ )

For convenience, we will rewrite the series P as

- series P ( $x_0^{(P)}, x_1^{(P)}, \dots, x_{127}^{(P)}; y_0^{(P)}, y_1^{(P)}, \dots, y_{127}^{(P)}$ )

A Fourier transform is done for the  $x_j^{(P)}, y_j^{(P)}, (j=0,1,\dots,127)$  respectively in the series P, and the real portion  $A_{x,k}^{(P)}, A_{y,k}^{(P)}$  and imaginary portion  $B_{x,k}^{(P)}, B_{y,k}^{(P)}$  of the Fourier transform coefficients are obtained. Then we have the relation

$$x_j^{(P)} = \sum_{k=0}^{63} [A_{x,k}^{(P)} \cos(2\pi jk/128) + B_{x,k}^{(P)} \sin(2\pi jk/128)]$$

$$y_j^{(P)} = \sum_{k=0}^{63} [A_{y,k}^{(P)} \cos(2\pi jk/128) + B_{y,k}^{(P)} \sin(2\pi jk/128)]$$

and then

$$j=0,1,\dots,127$$

$$X_P(k) = A_{x,k}^{(P)} + iB_{x,k}^{(P)}$$

$$Y_P(k) = A_{y,k}^{(P)} + iB_{y,k}^{(P)}$$

$$X_P^*(k)Y_P(k) = A_{x,k}^{(P)}A_{y,k}^{(P)} + B_{x,k}^{(P)}B_{y,k}^{(P)} + i(A_{x,k}^{(P)}B_{y,k}^{(P)} - A_{y,k}^{(P)}B_{x,k}^{(P)})$$

$$|X_P(k)|^2 = (A_{x,k}^{(P)})^2 + (B_{x,k}^{(P)})^2$$

$$|Y_P(k)|^2 = (A_{y,k}^{(P)})^2 + (B_{y,k}^{(P)})^2$$

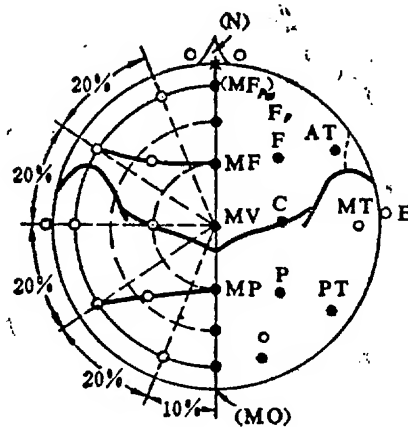
Equation (9) can be expressed as:

$$(r_{xy,k})^2 = \frac{\left[ \sum_{P=1}^{12} (A_{x,k}^{(P)}A_{y,k}^{(P)} + B_{x,k}^{(P)}B_{y,k}^{(P)}) \right]^2}{\sum_{P=1}^{12} [(A_{x,k}^{(P)})^2 + (B_{x,k}^{(P)})^2]} + \frac{\left[ \sum_{P=1}^{12} (A_{x,k}^{(P)}B_{y,k}^{(P)} - A_{y,k}^{(P)}B_{x,k}^{(P)}) \right]^2}{\sum_{P=1}^{12} [(A_{y,k}^{(P)})^2 + (B_{y,k}^{(P)})^2]} \quad (10)$$

The goal of computer EEG analysis is to extract visual characteristic information from the multi-path long-term EEG

recordings. Spatial analysis of the EEG signals (also called topological analysis), is to consider the EEG activity of the cerebral cortex from an overall angle, and has a visual and imagery oriented nature. In 1976, on the basis of a multi-path EEG parameter display, H.A. Harris proposed the "area display technique for spontaneous EEG signals and EEG induced electrical potentials, as well as EEG mapping. This technique uses a simplified cerebral cortex region which has two sectors with a certain area resolving power. Based on the position of each recording electrode and the recorded EEG signal, the EEG parameter of each recorded electrode position is obtained through analysis, and according to certain interpolation principles, the EEG parameter values of the total displayed area are calculated, and then an appropriate image is also displayed.

Fig. 1 Two-dimensional simplification of 10-20 electrode system.

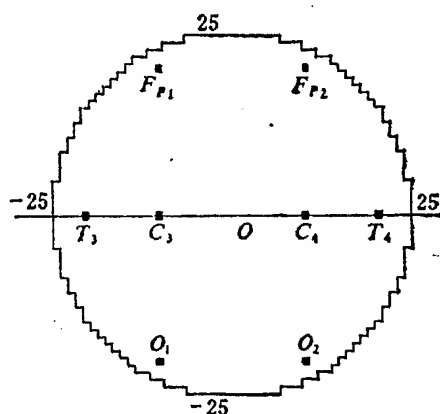


Normally the cerebral cortex (three-dimensional space) is simplified to a circular region, and through this simplification, the international 10-20 system electrode positions are displayed as in Fig. 1.

Looking at the interpolation calculation, many electrodes should be used, but because of the limitations of the EEG mapping unit (the ND-82B type 8 path EEG mapping unit), we are only able at one time to record 8 EEG signals, and from Fig. 1 we can see the appropriately chosen eight points as the recording electrode positions  $F_{p1}$ ,  $F_{p2}$ ,  $MT_1$ ,  $C_3$ ,  $C_4$ ,  $MT_4$ ,  $O_1$  and  $O_2$ . Fig. 1 should serve as a topographically mapped display region or a change of shape should be done, taking the circle and discretizing it into a quasi-circle made up of small squares. In determining the area resolving power (also a determination of the number of small

squares), it is important to look at the requirements of the analysis and the limitations of the equipment, and we take the diameter of the circle and divide it evenly into 49 sections, as shown in Fig. 2. Fig. 2 in all has 1906 output units (each small diamond is one output unit), and this time the 8 recorded electrode coordinates are:  $F_{P1}(-10,20)$ ,  $F_{P2}(10,20)$ ,  $MT_1(-20,0)$ ,  $C_1(-10,0)$ ,  $C_2(10,0)$ ,  $MT_2(20,0)$ ,  $O_1(-10,-20)$ ,  $O_2(10,-20)$ .

Fig. 2 Topographical map display area



At each recorded electrode position, the computer, through sampling, obtains a distributed EEG signal. After analysis and processing, each EEG parameter is obtained and matched with the value of each small black square in Fig. 2, while the value of each remaining position is sought through interpolation. The interpolation processing uses a linear interpolation method, with the value of certain points being found through linear weighting being done for the EEG parameters of the three recorded electrode positions nearest to the given point. The mathematical equation is

$$f(x) = k_1 f(x_1) + k_2 f(x_2) + k_3 f(x_3) \quad (11)$$

where  $f(\cdot)$  represents the EEG parameter of the point  $(\cdot)$  location,  $x$  is the point processed by interpolation,  $x_1$ ,  $x_2$ , and  $x_3$  respectively represent the distances  $x$  of nearest three electrode positions,

$k_1$ ,  $k_2$  and  $k_3$  are respectively the corresponding weight coefficients, and  $k_1 + k_2 + k_3 = 1$ .

Suppose the size of the weight coefficients is inversely proportional to the distance between two points. Using  $l_{ab}$  to represent the distance between  $a$  and  $b$ , we have

$$k_1 = k_0 / l_{x,x_1}, k_2 = k_0 / l_{x,x_2}, k_3 = k_0 / l_{x,x_3},$$

and from the equality  $k_1 + k_2 + k_3 = 1$  we obtain

$$k_0 = \frac{l_{x_1x} l_{x_2x} l_{x_3x}}{l_{x_1x} + l_{x_2x} + l_{x_3x}},$$

Let  $L = l_{x_1x} + l_{x_2x} + l_{x_3x}$ , then equation (11) can be written as

$$f(x) = \frac{l_{x_2x} l_{x_3x}}{L} f(x_1) + \frac{l_{x_1x} l_{x_3x}}{L} f(x_2) + \frac{l_{x_1x} l_{x_2x}}{L} f(x_3) \quad (12)$$

By reducing the multiplication frequency, the above equation can be rewritten as

$$\begin{aligned} f(x) = & \frac{l_{x_2x} l_{x_3x}}{L} [f(x_1) - f(x_3)] \\ & + \frac{l_{x_1x} l_{x_3x}}{L} [f(x_2) - f(x_3)] + f(x_3) \end{aligned} \quad (13)$$

For the value of the recorded electrode position, it is also possible to look at a special case of the above equation.

The EEG parameters in EEG power spectral mapping analysis are the total spectral density and the power spectral density of each frequency range. The distribution of each frequency range is given in Table 1. The power spectral density estimates use the stepwise smoothing method, with samples obtained from independent five-range EEG signals. The selection of each parameter and the coherence analysis time are identical.

Table 1

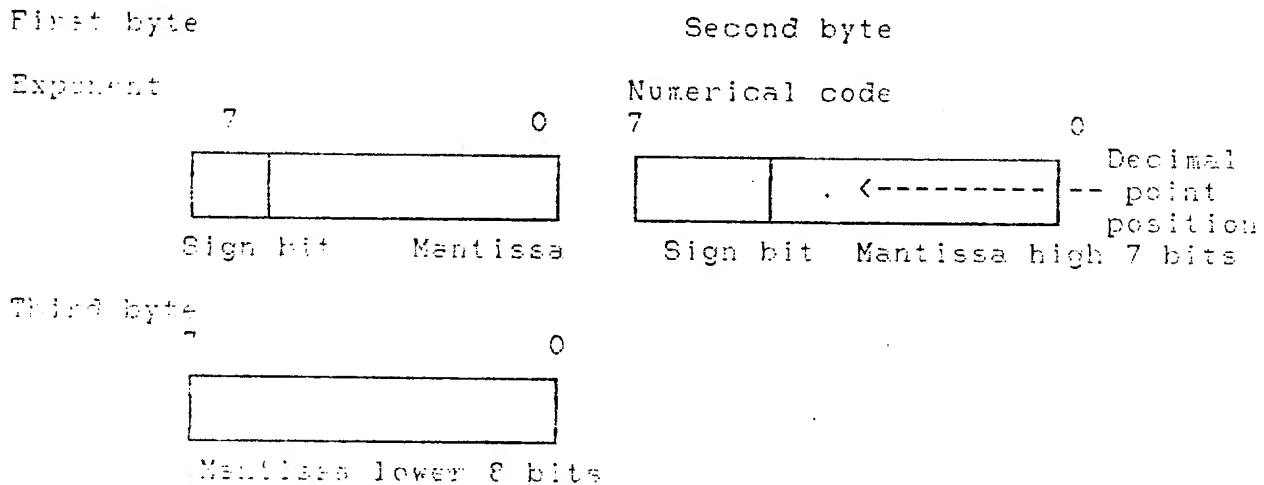
Frequency range	$\delta$	$\theta$	$\alpha_1$	$\alpha_2$	$\beta_1$	$\beta_2$
Frequency interval (Hz)	1.0-3.9	4.0-7.0	7.5-10.0	10.5-13.0	14.0-19.0	20.5-25.0

In coherence topographical map analysis, the coherence index of the left forehead ( $F_{p1}$ ) position EEG parameter is chosen from among the left and right foreheads ( $F_{p1}$ ,  $F_{p2}$ ), and the values of the other recorded electrodes are separated into the coherence index value from among the given EEG signal and the left forehead EEG signal, while the definition of the coherence index and that sought and chosen is the same as the previous.

Analysis was done on an Apple II microcomputer in order to reflect in real time the changing state of the EEG coherence index in the process of entering superquiescence. For the purpose of later being able to realize EEG coherence feedback training,

software design requires the use of a computer in the on-line processing mode, with the programs written in 6502 assembly language. The frequency spectral analysis uses the fast Fourier transform (FFT) method. In order to reduce the leakage signal, refining processing is done on the original data adding a cosine slope map. The use of the real sequence property of a Fourier transform makes it possible at the same time to conduct a discrete Fourier transform for the two EEG signals, in order to reduce the computer work load processing time for the FFT transform, and in the interpolation operation, each constant array produced by a BASIC program is sent to internal storage and supplied to the assembly language program when it is running.

In the 6502 assembly process, we define one number using 3 bytes, with the following form:



Here, in the sign position a 0 means positive and a 1 means negative. The mantissa of the exponent uses a complement representation, and the mantissa of the number uses an absolute value type representation.

The printout of the topographical map uses different gray scale (tonal) representation, with the gray scaling providing 11 gradations, with even quantization, and the printer output uses the density of the graph to represent the size of the gray scale.

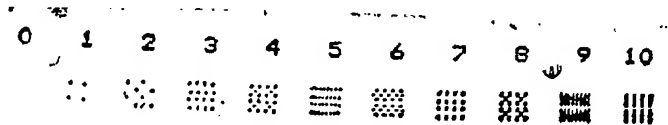


Fig. 3 EEG topographical map gray scaling

The main program of the system is written in BASIC, and after it is started, a transfer is done to the assembly language

program to do the coherence analysis, to find the power spectra, and to do the interpolation and quantization operations, after which control is returned to the main program, which reads the results of these operations and completes the coherence analysis and the printing of the topographical map.

The EEG coherence analysis and EEG coherence mapping program flow-charts are shown in Figs. 4 and 5.

### 3. Test Subjects and Methods

The test subjects were divided into three groups. The first group was the control group, consisting of 5 persons, all male, who had not studied Qigong, and ranging in age from the oldest, 26 years of age, to the youngest, 24 years of age, with an average age of 25. The second group was a group that practices Qigong and has practiced Qigong for periods ranging from 2 months to 4 years, in all 15 persons, 12 male and 3 female, with the oldest being 57 years of age and the youngest 22 years, and having an average age of 44 years. The third group was composed of people who have been Qigong practitioners for a comparatively long time, on average over 5 years, and was 5 people in all, all male. They ranged in age from the oldest, 60 years old, to the youngest, 30, with an average age of 52.



Fig. 4 EEG coherence analysis program flow-chart

1. Read in
2. Data standardization
3. Transfer to FFT subroutine
4. Spectral decomposition operation
5. Find

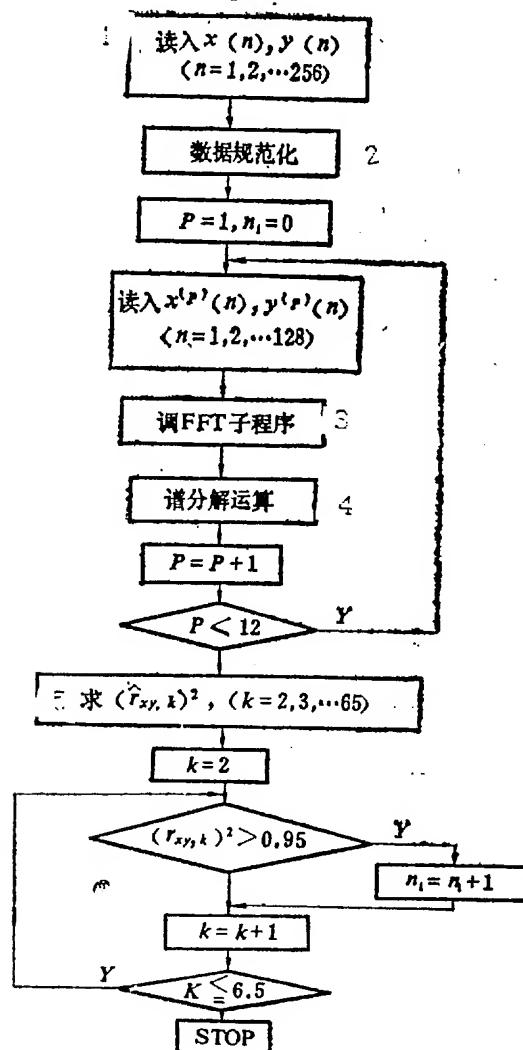
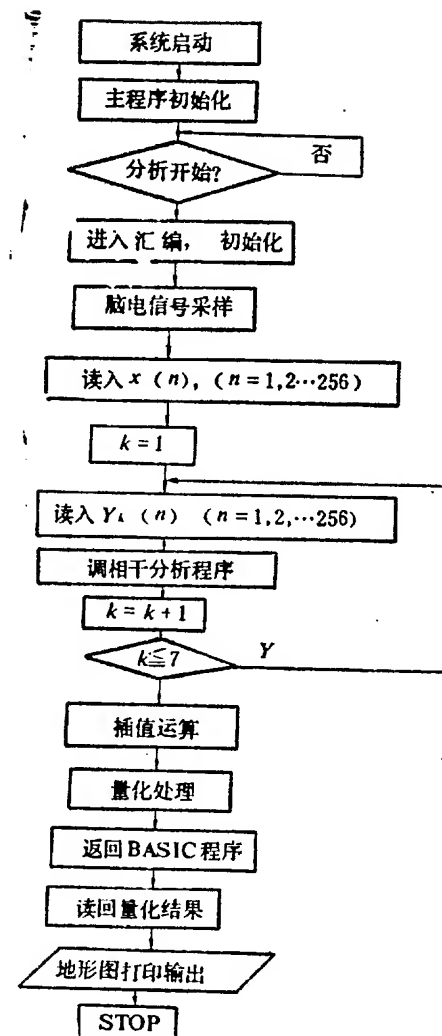


Fig. 5 EEG coherence topographical map analysis program

1. Start operation
2. Main program initialization
3. Start analysis?
4. No
5. Enter assembly language program, initialization
6. EEG signal sampling
7. Read in  $x(n)$ , ( $n = 1, 2, \dots, 256$ )
8. Read in  $Y_k(n)$ , ( $n = 1, 2, \dots, 256$ )
9. transfer to coherence analysis program
10. interpolation operation
11. quantization processing
12. Return to BASIC program
13. Read returned quantization results
14. Topographical map print output



Recording of the EEG is done with a deadened shielded box, and the shield layer (copper mesh) and the EEG unit are joined together well. Inside, a chair was set up, and in order to have a soft light, a direct current electrical signal lamp was erected. A fan and an anion generator were located on the top and bottom portions of the shielded box respectively, in order to provide fresh air. The environment was kept comfortable as far as possible beforehand in order to achieve good test results. For studying the superquiescent state, the Qigong practitioners were required to go through the following three conditions: 1) 5 minutes of rest before exercising; 2) during exercising, they were required to enter quiescence as rapidly as possible, exercising for 30 minutes; for the control group, they were required to imitate practicing Qigong using a method of their own understanding; 3) after exercising, stop, again rest and sit for 5 minutes. The required explanations were provided to the participants prior to the test, and during the test a loudspeaker was mounted in the box for notifying the participants when to start and stop with each condition. In order to avoid errors caused by eye movement, the exercising was required to be done with the eyes closed.

During the two EEG coherence analyses of the cerebral forehead region, the two signals were obtained from  $F_7$  and  $F_3$ . Taking the left earlobe as the reference electrode, both electrodes were traced and recorded, taking the central point  $C_1$  as the ground terminal. When doing the EEG topographic map analysis the single electrode recording method was used, still taking the left earlobe as the reference electrode.

The EEG signal, after being directed through the recording electrode to the EEG unit (ND-32B) and after amplification is output from the pre-output terminal of the EEG unit, and along one path, after amplification through an analog filter, is sent to an A/D converter circuit (the filter is a two stage lowpass filter, with a cutoff frequency of 40 Hz, and an amplification factor of 10, while the A/D converter has an accuracy of 8 bits), for directly conducting analysis and processing. The other signal is sent to a magnetic tape recording unit as a reset signal.

For the EEG power spectrum topographical map analysis, it was required that each amplification factor be strictly identical. It is possible to use the EEG mapping unit's calibration signal as a simulated input/output signal to adjust each amplification factor to satisfy requirements. For the coherence analysis, there is no need to talk about amplification factors, but considering the results after a Fourier transform during the coherence analysis program, a gate value is determined (when the value is smaller than the given gate value the given value is set to zero), and for this reason we also should maintain each amplification factor equal.

## 4. Results of the Analysis

## 1. EEG coherence analysis of the cerebral forehead region.

Through EEG coherence analysis, we obtained the time (distribution) of each of the test participants during the testing process-- the correspondence relation of the EEG coherence index, as shown in Fig. 6. In the figure, the x-axis is the time axis (each 30 seconds counts one point, hence 60 represents 30 minutes), and the y-axis is the coherence index value.

We conducted analysis of the coherence index obtained for the three time periods. The three time periods were before exercising, during the conduction of exercising, and the after exercising period. An average was obtained for each stage for 5 coherence indices (equal to the average coherence index within 2.5 minutes). The results of the analysis are shown in Table 2.

Fig. 6 EEG coherence analysis

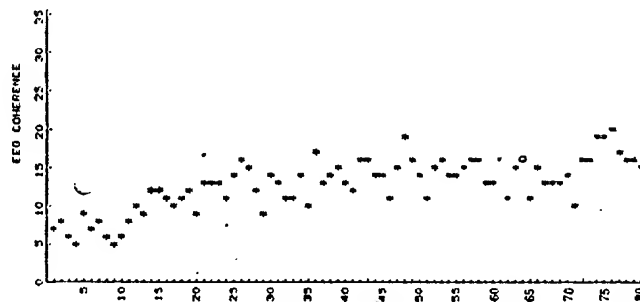


Table 2

1. Time
2. Parameter
3. Group
4. Before
5. During
6. After
7. Average value
8. RMS error
9. First group
10. Second group
11. Third group

组 别	时 间 参 数		功 前		刚进入功中		功 中	
	均 值	均方差	均 值	均方差	均 值	均方差	均 值	均方差
第一组	6.36	0.408	6.36	0.852	6.48	1.121		
第二组	6.08	1.411	6.63	2.232	*7.387	1.297		
第三组	6.45	0.84	**9.5	1.212	**11.45	2.177		

\* shows under the  $p = 0.01$  significance level a clear rise (in comparison with before)

\*\* The examination's significance level is  $p = 0.005$ .

Table 2 shows that during exercising, the two coherence

indices of the Qigong group's cerebral cortex forehead region clearly rose ( $p < 0.01$ ). The normal exercising group (group two) had an increase in their coherence indices during exercising, though this increase did not reach the significance level, and this group had more relation to Qigong novices (those who have practiced for 2 months). The coherence index value of this group after 30 minutes of practice showed a marked rise.

### 2. Coherence topographical map analysis

We conducted analysis on the coherence topographical maps of the Qigong practitioners of the three groups.

For the control group, there was basically no change in the coherence topographical distribution in two tests, and there was only a slight increase in the rear area of the cerebrum and a slight decrease in the frontal area.

The second group, in comparing the period during exercising and the period before, had an increase in both the front and rear part of the cerebrum (both the forehead area and the occipital region), while there was no noticeable change in other areas.

For those with a longer exercise time, the coherence topographical maps in the process of entering the superquiescent state are shown in Figs. 7 and 8. It may be seen that before exercising there is not much difference with a normal person, but when entering into practice, the coherence index of each region increases. After having entered the superquiescent state for several minutes, the increase in the frontal region of the cerebrum and the left side is quite clear. After 30 minutes of practice, a comparison of before and after shows that the coherence index of each region of the cerebrum has had a marked increase, and the temporal lobe is particularly notable. In comparing four EEG coherence topographical maps, one also discovers that at first, for the three time periods, the coherence of the left side of the cerebrum is dominant, but finally, the coherence index of the right side of the cerebrum is very great, exceeding that of the left side. This indicates that in the superquiescent state, each region of the cerebrum is strengthened, particularly the nerve system relations between the right and left hemispheres.

### 3. Power spectral map analysis

The control group EEG power spectrum map analysis: the control group power spectrum distribution in the occipital region is dominant. The energy distribution before and after exercising shows no great change. The EEG energy concentration in the frequency range (10.5-13.0 Hz), and the proportion of the energy in the overall energy for the  $\alpha$  frequency range before and after the test increased. It may be seen from an analysis of the relative power spectrum of the  $\alpha$  frequency range that the energy concentration in the occipital region, and in the right and left hemispheres was basically a symmetric distribution.

The second group EEG power spectrum map analysis: during the process of entering the superquiescent state, overall energy was transferred from the occipital region to the forehead region, and the energy of the other regions also had tendency to have a relative concentration at the forehead region, and the  $\alpha_1$  frequency range (7.5-10.0 Hz) power spectrum map analysis also shows this, and one notes the EEG dominant frequency is in the  $\alpha_1$  range.

Master Gigung practitioner power spectrum map analysis: comparing during exercising and before, the most clear characteristics is that the EEG wave amplitude suddenly increases substantially. Beforehand, the dominant frequency is in the  $\alpha_1$

Fig. 7 [Title covered up]

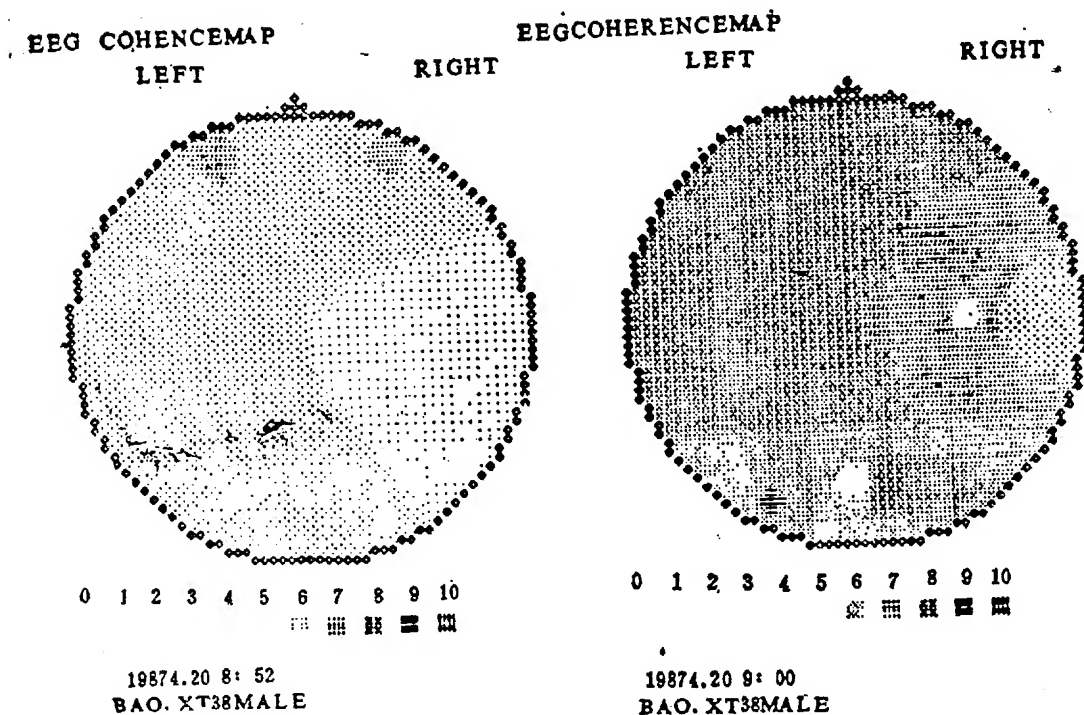


Fig. 8 The EEG coherence map changes for master practitioners who have entered the superquiescent state

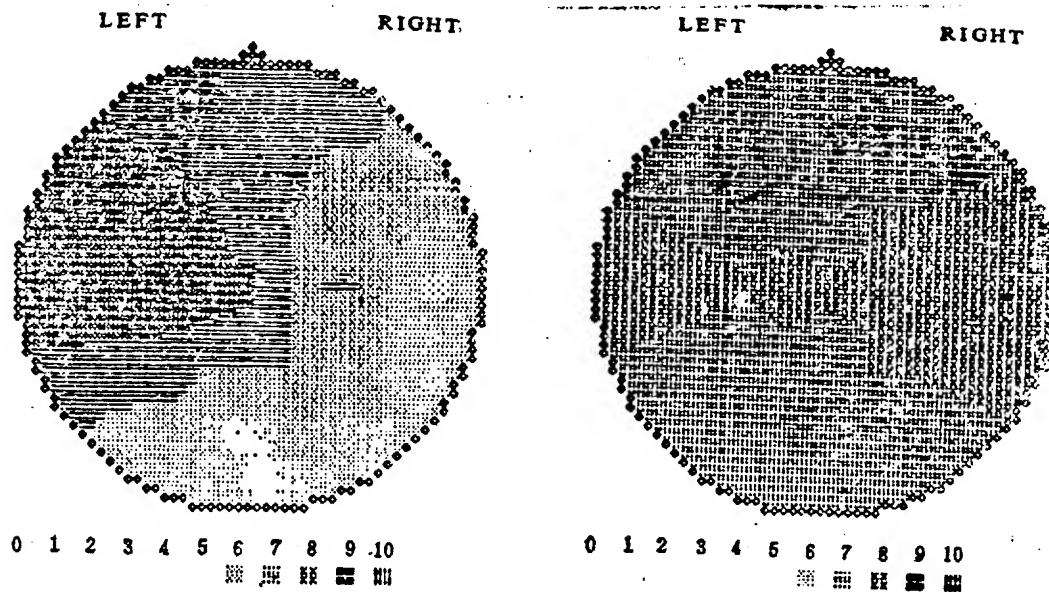


Fig. 9 Comparison of  $\theta$  range power spectral map distributions for master practitioners

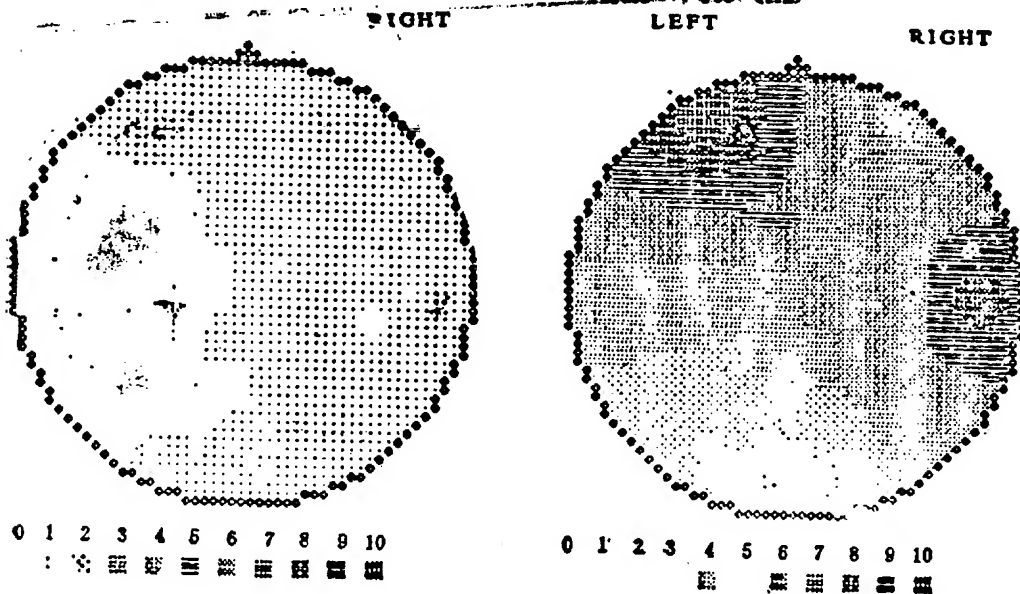


Fig. 10 [Title covered up]

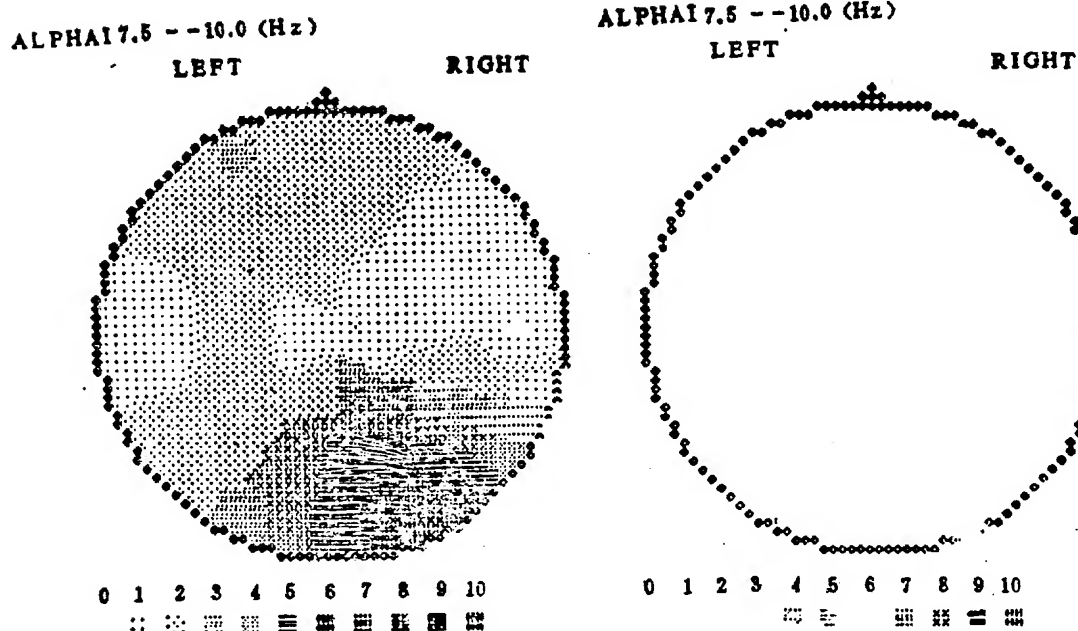
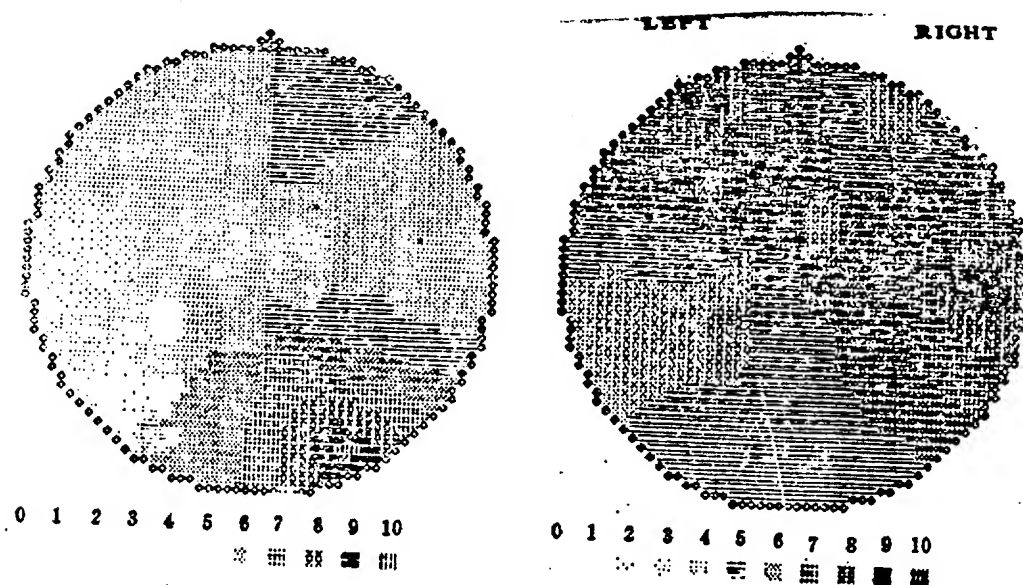


Fig. 11 EEG overall power spectral map analysis contrast for those who have entered the superquiescent state for a comparatively longer time



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frequency range, while during exercising, the dominant frequency shifts into the  $\theta$  frequency range, and the EEG activity of the  $\alpha$  frequency range seems to disappear (Fig. 9, Fig. 10). The energy also undergoes a shift from the before exercise center in the occipital region to the forehead region and right temple (Fig. 11). In comparing the left forehead recorded  $\theta$  frequency range power spectrum during exercising and the pre-exercise right occipital recorded  $\alpha$  frequency range power spectrum, the former is 210 times the latter. The dominant  $\theta$  wave amplitude during exercising compared to the dominant  $\alpha$  activity wave amplitude should increase by 12.5 times. In addition, there is a growth in the EEG activity amplitude in the entire head region. The relative power spectrum distribution of the  $\alpha$  frequency range shows no major change.

During the other two tests, a similar dominant frequency drop to the  $\theta$  frequency range was recorded, and the EEG wave amplitude increased tenfold.

It is generally believe that under the superquiescent state, the EEG dominant frequency has a slight drop, and the EEG power spectrum increase is quite large. Yet there has been little reporting on the above changes, and it merits further research.

## 5. Conclusions and Discussion

In summing up the above analysis, we have obtained that under the superquiescent state:

- (1) The EEG coherence index of each region of the cerebrum shows a marked increase;
- (2) The EEG amplitude suddenly increases, and the energy shifts from behind the cerebrum to the front;
- (3) The EEG dominant frequency is reduced.

In order to objectively reflect the depth to which the Qigong practitioners enter superquiescence, we proposed the concept of the superquiescence level, which is used to reflect the degree to which the practitioner is able to eliminate distracting thoughts.

After going through the above analysis, we believe that there are three indices to consider in terms of the superquiescence level:

- (1) The coherence index value of each cerebral region.

Suppose the number of EEG recording electrodes is  $n$ , and the EEG coherence index of each recording electrode position is  $C(i)$  ( $i = 1, 2, \dots, n$ ), and suppose that when doing the frequency spectrum analysis, in all there are  $N$  frequency spectrum components. Then we will consider the influence of the coherence index on the superquiescence level to be

$$Q_c = \frac{1}{nN} \sum_{i=1}^n C(i) \quad (14)$$

(2) The amplitude of the EEG signal of each cerebral region.

Suppose the number of EEG recording electrodes is  $n$ , and the  $i$ -th recording electrode position EEG signal at the  $k$ -th frequency component position's power spectral width is  $S_{i,k}$ , ( $i = 1, 2, \dots, n$ ,  $k = 0, 1, \dots, N$ ), then we will consider the influence of the EEG amplitude on the superquiescence level to be

$$Q_s = \sqrt{\sum_{i=1}^n \sum_{k=0}^N S_{i,k}} \quad (15)$$

(3) The drop in the EEG dominance frequency.

Suppose the dominant frequency of the EEG signal before entering the quiescent state is  $f_{db}$ , and the EEG dominant frequency after entering the superquiescent state is  $f_{da}$ . Then we will consider the influence of the dominant frequency difference on the superquiescence level to be

$$Q_d = f_{db} - f_{da} \quad (16)$$

In addition, we will should also consider the condition where the EEG energy is shifted from the rear to the front.

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## Turbidity Analysis of Brain Waves During Qigong

HU Xiehe and HU Zhongyi (Zhejiang University)

### Summary

This article uses the method of non-linear kinetics to analyze the turbidity of brain wave signals (time series) of subjects who practice qigong. The results show that fragment attractors of the brain wave signals (the system) of those who practice qigong do generally exist, but in terms of the value of their dimensions,  $d$ , it varies by person.

### I. Introduction

In recent years, we have been striving for the testing, analysis and research of indexes for the qigong functional state; we have conducted a large amount of clinical experimentation and data analysis at the Shanghai Chinese Medicine Research Institute, the qigong ward in the Zhejiang Jiangong Hospital and other places. Recently, we have received a bidding project from the Ministry of Public Health: An analytical system of micro-computers for the functional state of qigong. For this project, we conducted a series of clinical experiments and data processing in the lab. This article will relate one aspect of our work.

According to statistics, up to now, the most widely researched area on qigong is the brain wave power spectrum. Many research groups, including the authors, have done research in this area. The major conclusions are: during qigong, the index of a wave in most subjects' brain wave spectrum increases<sup>[1-2]</sup>. But this conclusion does not apply to all of those who practice qigong. For some subjects, during qigong, the  $\alpha$  wave decreases instead of increasing, because the increase or decrease of the index of a wave is closely related to the degree to which the  $\alpha$  wave ordinarily exists in this person's brain waves. Therefore, the use of the  $\alpha$  wave index to measure the effectiveness of a qigong practice and the degree of entering quiescence is worth looking into further.

New developments in physics and non-linear kinetics provide us with a series of methods to analyze and study the multi-variables, non-linear characteristics and complex systems. In terms of the brain wave signals of the subjects who practice qigong, it is undoubtedly one of the most complex systems in nature. For this reason, can we use the method of turbidity kinetics to study brain waves? Can we determine from our study a set of indexes for the analysis of the functional state of qigong and the degree of entering quiescence? This article explores the first question and has a positive answer to it; for the second question, we hold a very optimistic attitude.

## II. Theoretical Basis

We obtain brain wave signals from the skin of the skull of the subjects who practice qigong. From the surface, the time series of this single variable can only provide rather limited information. Some people, in particular, will say that it is rather limited to use a "one dimensional" approach to the process of a system of numerous interwoven variables. In reality, this time series contains much richer information: it contains all the traces of all the variables of the dynamics involved; it makes it possible for people to confirm some important characteristics latent in a system, which have nothing to do with any model.

To analyze the turbidity of brain wave signals, one first must prove whether there are fragment attractors existing in brain waves. If there are no attractors, there will be no turbidity to talk about; secondly, one must solve for the dimension of the fragment attractors,  $d$ , when  $d=1$ , the system we process is the self-maintaining period oscillation; when  $d=2$ , we face two incompatible quasi-period oscillations; only when  $d$  is an incompatible quasi-period oscillation, and only when  $d$  is not an integer or is larger than 2 (fragment attractors, see section 3.10 in reference [3]), will the system indicate a sensitivity to the primary condition and possess unpredictable eigen turbidity oscillations.

### 1. The system to be proven

The question is whether or not brain wave signals contain attractors; all is needed is to draw its phase plot, with  $X(t)$  as its horizontal axis, and  $X(t+r)$  as its vertical axis, and see if its phase trace can be restricted within a sub-set of a quadrant. If it is, there must be attractors in the system (and this sub-set is called a attractors).

2. The dimension of the attractor can be determined through the following steps

(1) Suppose our obtained brain wave time series is  $X_0(t)$ , now introduce a vector  $X_i$

$$X_i = (X_0(t_i), X_0(t_i+r), \dots, X_0(t_i+(n-1)r)) \quad (1)$$

$$(i=1, 2, \dots, N)$$

In the formula,  $n = m\Delta t$ ,  $m$  is a positive integer, and  $\Delta t$  is the sampling time.

(2) For different  $i$ 's, solve for the distance between  $X_i$  and  $X_j$ , that is

$$r_{ij} = |\bar{X}_i - \bar{X}_j| \quad (i, j = 1, 2, \dots, N, \quad j \neq i) \quad (2)$$

(3) For  $r$  of different values (the value of  $r$  is a rather small positive integer), solve for  $C(r)$

$$C(r) = \frac{1}{N^2} \sum_{\substack{j=1 \\ j \neq i}}^N \theta(r - r_{ij}) \quad (3)$$

In the formula,  $\theta(X)$  is Heaviside function, that is

$$\theta(X) = \begin{cases} 1 & (X > 0) \\ 0 & (X < 0) \end{cases} \quad (4)$$

$r$  is a standard to measure the distribution of  $X_i$ . The measurement of the non-zero  $C(r)$  affects the degree of distribution of other points because of the existence of  $X_1$ . Therefore,  $C(r)$  can be considered as the attractor's integral correlation function.

(4) In calculating the dimension  $d[4]$  of the attractor, because

$$C(r) \propto r^d \quad (5)$$

therefore

$$d = \ln C(r) / \ln r \quad (6)$$

The  $d$  here is the dimension of the attractor.

### III. The Steps in the Experiment

We let the subjects sit quietly in a screened room, put four electrodes on their heads; the measured brain wave signals are sent out through cables from the screened room into an eight-track electroencephalogram (EEG); after noise filter and magnification, it is sent to a four-track tape recorder and the signals are recorded on the recorder.

During the analysis process, the brain wave signals are retrieved from the tape; after IBMPC sampling, the original data is sent through network into a VAX-II mini-computer to go through a series of processing and analysis steps.

#### IV. Results of Analysis

##### 1. Proof of the existence of attractors

Following the method explained in Section II, we plot phase trace diagrams of the subjects' brain waves. The diagrams show that their phase trace stabilizes within a certain area, which is a sub-set of a quadrant; therefore, attractors do exist. This conclusion is consistent with the study<sup>[1]</sup> on brain wave attractors of the sleep phase, done by A. Babloyantz and others; the shapes of the diagrams are more or less similar (see Fig. 2); in Fig. 1,  $r=10$ ; the sampling frequency is 100Hz, total time is 20 seconds, and the differentiating frequency is 10bit. (Insert Figs 1 and 2)

##### 2. The dimensions of attractors

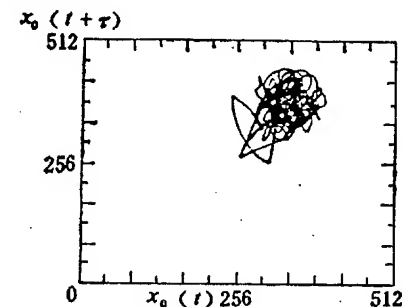
Fig. 3 plots the curves of  $\ln C(r)$  and  $\ln r$  at various times,  $n$ . The slope of the curve in the diagram is the dimension  $d$  of the attractors; the diagram shows when  $n = 6$ , slope  $d$  is unchanged. This is the first saturation value  $d$ , which is the dimension of the attractor for the corresponding brain wave signal system; here  $d = 2.10$ .

Fig. 4 shows the curves of  $d$  and  $n$ ; Table 1 gives their actual values.

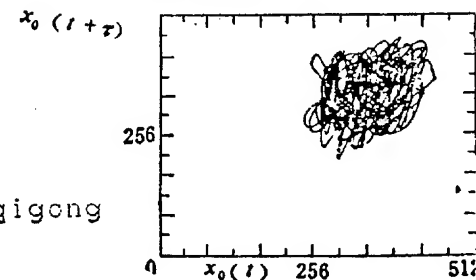
Following this method, we analyzed four cases; their situations are basically the same, but the  $d$  value is different. The result is shown in Table 2.

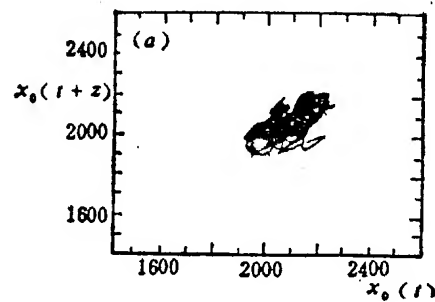
Fig. 1 Two dimensional diagrams of the subjects.  
 $f=100\text{Hz}$ ;  $r=10$  ,  $N=1000$  total 10s. Plotted on VAX-II.

(a) The phase plot for before qigong.

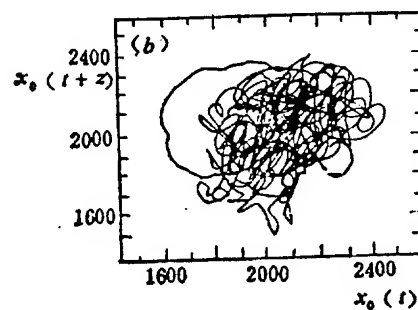


(b) The phase plot for 10 minutes into qigong





(a) The awake phase



(b) The fourth stage of the sleep phase.

Fig. 2 Two dimensional Figs of the sleep phase plotted on EEG.  
 $f=100\text{Hz}$ ,  $r=10\Delta t$ ,  $N=4000$  total 40s. Plotted on PDP 11-44.

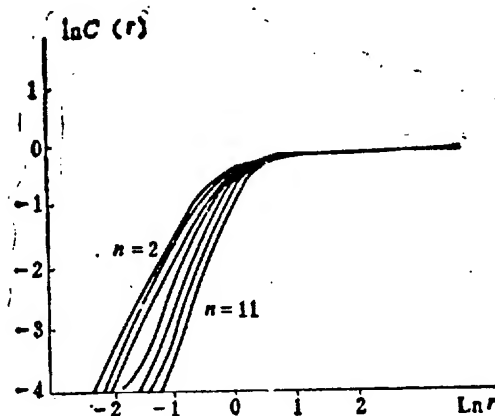


Fig. 3 The curve relation of  $\ln C(r)$  and  $\ln r$  to the various time,  
 $n$ .  
 $f=100\text{Hz}$ ,  $N=2000$ ,  $N=500$ , Plotted on VAX-II

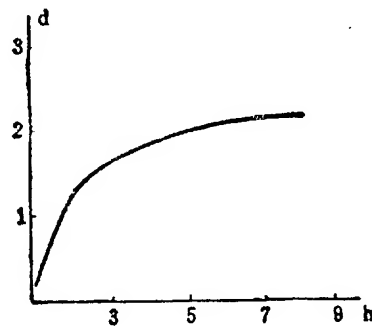


Fig. 4 The curve relation between  $d$  and  $n$

Table 1 The relation between  $d$  and  $n$

$N$	$D$
2	1.217
3	1.614
4	1.783
5	1.946
6	2.103
7	2.137
8	2.161

Table 2 The subject and the  $d$  value

Subjects (by number)	$d$ value
No.1	$2.10 \pm 0.10$
No.2	$1.51 \pm 0.10$
No.3	$1.17 \pm 0.10$
No.4	$2.24 \pm 0.10$

## V. Conclusion

The above analysis shows that for the subjects, their brain wave signals appear turbid (i.e. there are fragment attractors);



but the distribution of the dimension  $d$  value of their attractors is wide, see Table 2. On the other hand, the  $d$  value of the dimension of the attractors, which we obtained from the head of the subjects ( $d$  value is approximately between 2 and 3), differs greatly from other people's results, which are for the awake phase ( $d=5$  approximately) and the sleep phase ( $d=4$  approximately). Perhaps the value difference can be used to measure the difference in the qigong skills of the subjects. But this is only an assumption; specific effort to prove it must be carried out.

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The Distance Transcending Effect of  
External Qi, And Analyzing it Using Laser Raman Observation  
of Solutions Which Have Physiological Effects

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Summary

Using a SPEX1403 Laser Raman Spectroscope, through checking and measuring of such solutions as tap water, physiological saline, glucose solution, maidimeisu solution, etc., all of which have physiological effects upon the qigong masters' release of external or received qi in transcending distance (several meters to 1900 km), it was discovered that the Laser Raman spectrum of the samples of solutions go through changes with the effect of external qi.

Scientific experimentation on qigong, especially the scientific experiments conducted by the first-class qigong masters, is different from other scientific experiments. This article presents a detailed explanation on how to design experiments of this kind.

I. Introduction

The practice of qigong and the use of external qi to cure sicknesses and the unusual effects it achieves have gradually drawn the interest of scientists.

But everybody is hoping for some breakthrough on such a mysterious and profound subject.

Based on the many years of research on qigong science, we have realized that scientific qigong research experimentation must involve the help and participation of the experienced and seasoned first-class qigong masters, the thinking out and planning of the experiment must be improved, and modern analytical equipment must be used for checking and measuring.

For this purpose, we completed some rather difficult experimentation on solutions, such as tap water, 0.9% physiological saline, 50% glucose solution, a 1.5mg/ml maidimeisu solution and other samples, over which the distance transcending

external qi has a physiological effect; we used a laser Raman spectroscopy for checking and measuring to observe and determine whether external qi affected the samples.

## II. The Method and Design of the Experiment

Equipment used for the experiment. In this experiment, the equipment used was a SPEX1403 laser Raman spectroscopy. Its main functional indices are as follows:

Resolving power	$0.15\text{cm}^{-1}$ (Hg579.1nm)
Raman shift interval	5--4000 $\text{cm}^{-1}$
Wave accuracy	$1\text{cm}^{-1}$ ( $<4000\text{cm}^{-1}$ )
Repetition	$0.2\text{cm}^{-1}$

Samples. Tap water, medical 0.9% physiological saline, medical 50% glucose solution, and a 1.5mg/ml maidimeisu solution. The total concentration of  $\text{Ca}^{++}$ ,  $\text{Mg}^{++}$ , and  $\text{Na}^{++}$  is 5.7mg/l.

Experiment design. In the past ten years, scientific experimentation and research on qigong has developed rather quickly. From an experimental methodological point of view, these efforts can be put into three categories: (1) Directly applying external qi to the detecting head or sensor, in order to discover the its composition and its functional mechanisms. (2) During the release of external qi and the circulation of internal qi, using various means to measure the change in various physiological parameters and organisms in human and other biological bodies. (3) Directly apply external qi to detached organisms (such as cancer cells) and other bacteria, and then using modern analytical method to closely analyze and study its functional mechanisms.

Now it is clear that the manifestations of qigong's effects are numerous. And the layers of gongli (the force or intensity of qigong energy) are rather complex. Under the effect of the external qi from first-class qigong masters, the detecting head (sensor) of modern analytical equipment as well as its other parts (exchange, magnification, display) can all be affected, which may lead to false results in the experiment. This is why in a first-class qigong experiment, great care is needed when adapting the original positional (in situ) experimental method.

In past experiments, the functional system of "person--person" or "person--living organisms" is usually adopted, which means the qigong masters release external qi to persons, living bodies or living organisms, and it is measured by equipment. This kind of experiment cannot eliminate the psychological effect on the recipient of the external qi. In terms of the living organisms, individual as well as environmental differences can

also be factors.

Therefore, it is necessary to design this kind of experiment to completely eliminate the interfering elements from the biological background. The experimental system is actually formed by person--object. That is, the external qi released by the qigong masters is done on a lifeless object.

In experiments of this kind, our standard for selecting samples is that their structures must be simple, they are stable under normal circumstances, and they possess certain biological effects.

Because in the body of an adult, the various tissues and the body fluid consists over 65% of water, it is appropriate to select tap water, medical 0.9% physiological saline, medical 50% glucose solution, and a 1.5mg/ml maidimeisu solution, all of which have biological effects. Because tap water, physiological saline, and such solutions are very stable under normal circumstances, we must ask the help of first-class qigong masters in order to have any effect on them. Therefore, in qigong experimentation research, the qigong masters must be involved in the planning and decision of the experiment. At the same time, the gongli of qigong masters can be affected by their energy, state of mind, time, environment, and many other complex conditions. Hence, whether the experiment can go on, how qigong is done or when it is done must be decided by the qigong masters. This differs from ordinary scientific research; in experiments of this kind, the qigong master is the main participant. This is exactly the unique characteristics of science research involving the human body.

In addition, in order to confirm the belief that distance transcending external qi can cure sicknesses, we designed an experiment in which the qigong masters do not touch the sample but do the external qi from a distance of several meters to dozens of kilometers, with the longest being 1900 kilometers.

Obviously, the degree of difficulty in this type of experiment is extreme. Each time before the experiment, depending on different situations and conditions, the qigong masters must use many different methods for generating qigong energy), as part of preparation, they use fagong (the initial stage of qigong, which is the beginning of the generation of energy) and shougong (the ending of the generation of energy, the concluding phase). But since the gongli of the qigong masters can be affected by their energy, state of mind, environment, and other conditions, in every experiment, the effect of their fagong and its force vary. Under such conditions, one should not demand unlimited repetitions of the experiment. However, as long as we

are clear on the background of the experiment, and our analytical method is applied correctly, we can still tell false results from real ones in a limitedly repeated experiment.

The checking and measuring conditions. For those qigong masters who generate great energy, using the original positional method may cause interference in the analytical equipment; therefore, we place samples in a designated lab to receive fagong (within the same lab there are other samples for receiving fagong). After fagong, it is checked and measured on the laser Raman spectroscope. To determine if the equipment is working properly, one must frequently measure the standard sample (the background). In this experiment, the measuring conditions are: the laser spectroscope is an Ar spectroscope, the measuring power is 400mW--500mW, the wave length is 5145 Å, lighting type is 90° and the scanning speed is 0.5s.

Control experiment. In this experiment, all samples are mixed solutions taken from large containers, which will guarantee the consistency of the samples (including the background control and samples). Before each experiment, all the background samples are tested. The results show that all the measuring of the control samples through laser Raman spectroscope is consistent. Fig. 1, 2, 3, and 4 are respectively the control spectrum diagrams of tap water, medical 0.9% physiological saline, medical 50% glucose solution, and 1.5mg/ml meidimeisu solution.

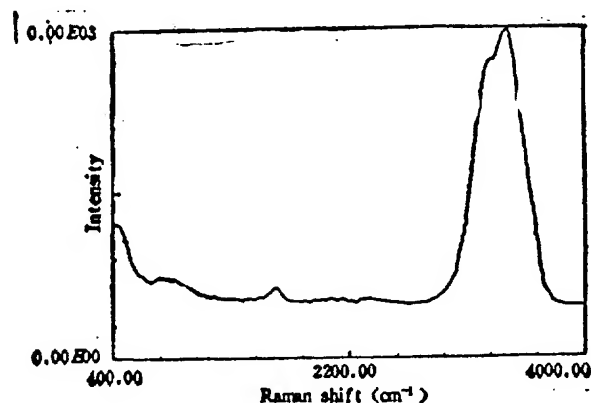


Fig. 1 Raman spectrum diagram of normal tap water

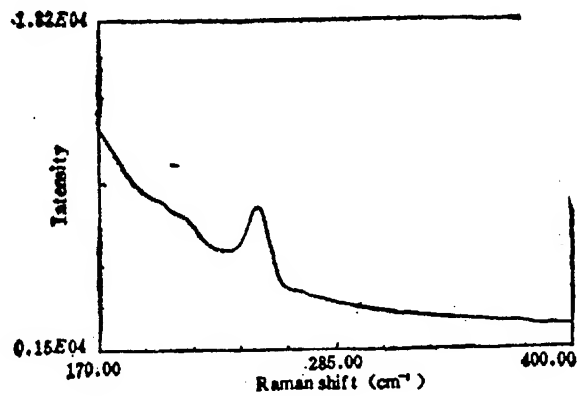


Fig. 2 Raman spectrum diagram of normal medical 0.9% physiological saline

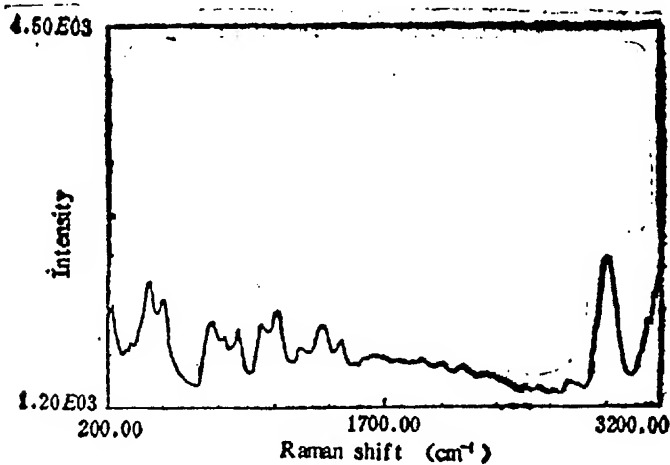


Fig. 3 Raman spectrum diagram of normal medical 50% glucose solution

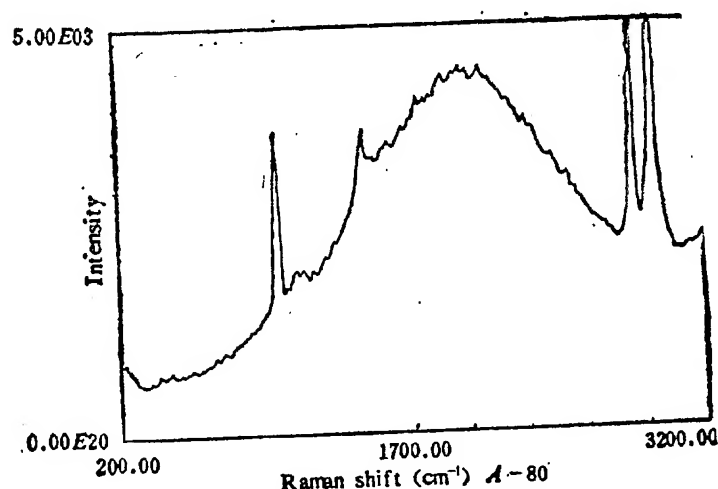


Fig. 4 Raman spectrum diagram of 1.5mg/ml maidimeisu solution

The qigong experimentation method. Before each experiment, the preparation of samples is: use a small glass tube to take out samples from glass containers full with samples; then seal it. Each sample is divided into two groups; each group consists of 2-3 tubes. One group of tubes will be target samples for fagong, and the other group will be kept, untouched by fagong, as control samples. All the sealed samples must be checked and measured to be background. The samples for the experiment must be deposited into a designated lab, the door of which will be locked, and nobody will be allowed in before fagong. Doctor Yan Xin will be a long distance away and begin to fagong at the designated time. The fagong distance is 7 kilometers. The duration of fagong is normally under 10 minutes. After fagong, the samples will be transported to the lab containing the laser Raman spectroscopy for checking and measuring. The control samples will be kept in the laser Raman lab throughout.

The experiment is done using a double-blind method; that is, the sealing, checking and measuring are all done by the equipment operator; no other person is allowed. Neither is anyone allowed in the laser Raman lab during the checking and measuring. The situation and condition of this group of experiments is listed in Table 1.

Table 1 Conditions of the Experiment

Date	Content	Temper. °C	Method of Communic.	Distance	Result
12/22/96	Tap water	13		3m	Change

12/27/86	Tap water	12	phone	7km	Change
12/31/86	Tap water Glucose solut. Physiol. saline	12		20m	Change
1/5/87	Glucose solut. Physiol. saline	13	phone	7km	Change
1/8/87	Tap water Glucose solut. Physiol. saline	11	phone	7km	Change
1/9/87	Tap water maldimeisu solution	11	phone	7km	Change
1/12/87	Glucose solut. Physiol. saline maldimeisu solution	10	phone	1900km	Change
1/17/87 <sup>6</sup>	Glucose solut. Physiol. saline maldimeisu solution	11	phone	1900km	Change
1/20/87	Glucose solut. Physiol. saline maldimeisu solution	11	phone	1900km	Change
1/23/87	Glucose solut.	11	phone	1900km	Change

### III. Results and Discussions

Tests on tap water. Over twenty tests on the background of tap water demonstrate that there is an -OH contracting oscillation peak area around  $3410\text{cm}^{-1}$  in the laser Raman spectrum diagram, while around  $1635\text{cm}^{-1}$ , there is an accompanying -HOH distorted weak oscillation area. But after distance transcending external q/, the laser Raman spectrum diagram of the tap water shows that there is a huge unknown peak within the  $1000\text{cm}^{-1}$ -- $3000\text{cm}^{-1}$  range. The typical result is shown in Fig. 5. In the experiment, on the condition that the analytical condition remains unchanged, we conducted a trace test. The result shows that this peak diminishes and disappears within one hour. The result is shown in Fig. 6. Because test samples and control samples are taken from the same container of tap water, and the background spectrum of the control sample remains normal; hence there is no possibility of contamination causing fluorescence. Moreover, this kind of unknown peak appears numerous times in the



laser Raman spectrum of test samples after they have received external qi, but it never appears in the background spectrum test of the control samples. There is, therefore, sufficient reason to believe that the appearance of this unknown peak is caused by external qi.

Tests on medical 0.9% physiological saline. Under distance transcending external qi, there are some changes in the Raman spectrum of the 0.9% medical physiological saline, in comparison to the normal control spectrum. These changes mostly appear in the shifting of the  $248\text{cm}^{-1}$  to  $238\text{cm}^{-1}$  of the low wave range between  $200\text{--}260\text{cm}^{-1}$ . Its typical result is shown in Fig. 7. Because Doctor Yan Xin did fagong differently each time, the changes as indicated in Fig. 8 are also noted. Obviously, peak  $248\text{cm}^{-1}$  disappears. Of course, like the test on tap water, the spectrum of the control samples remain unchanged throughout. This fact shows that the equipment is functioning normally, and the changes in the laser Raman spectrum of test samples are caused by external qi.

Tests on medical 50% glucose solution. Like the tests on tap water and medical 0.9% physiological saline, after super distance external qi, the Raman spectrum of the glucose solution shows changes in comparison to the spectrum of the control spectrum. Its typical result is shown in Fig. 9. Obviously, in Fig. 9 there is the phenomenon of the disappearance of the  $710\text{cm}^{-1}$  peak.

Trace tests on physiological saline and glucose solution show that the Raman spectrum on the samples in the four days of tracing after external qi do not appear to change.

Test on 1.5mg/ml maldimeisu solution. After external qi, the Raman spectrum on the maldimeisu solution, in comparison to the Raman spectrum of the control sample, also shows changes. Likewise, these changes appear in many tests. Its typical result is shown in Fig. 10. Obviously, the  $207\text{cm}^{-1}$  peak shifts to  $197\text{cm}^{-1}$ . Since the above four solutions are stable under normal room temperature, and we also check to see if the equipment functions properly by checking the control samples before and after the test, and randomly check the samples during the test; therefore, we can definitely determine whether the laser Raman spectrum on the external qi samples shows any changes over the laser Raman spectrum of the control samples that do not receive external qi.

The tests show, under the distance transcending effects of external qi of Doctor Yan Xin, changes of varying degree occur in the Raman spectrum for the four sample solutions of physiological characteristics used in the experiment. This fact shows that

external *qi* has affected the structure of these solutions to a certain extent. Therefore, this experiment also reminds people that one of the ways qigong masters cure sicknesses in people with external *qi* is through the effect of external *qi* on the fluids and tissues in human bodies, causing a certain degree of structural and functional change, thereby achieving the effect of cure through physiological adjustment. Therefore, development of this kind of experimental research is of significance.

Of course, this work only uses a Laser Raman unit to measure and confirm the effects of external *qi* used by a qigong master on several solutions having physiological effects. The work is still in an early stage. But in order to for deeply probe the mechanism of the biological effects produced by external *qi* on matter, especially the mechanism of distance transcending external *qi*, in the future it will be necessary to conduct much further in-depth research.

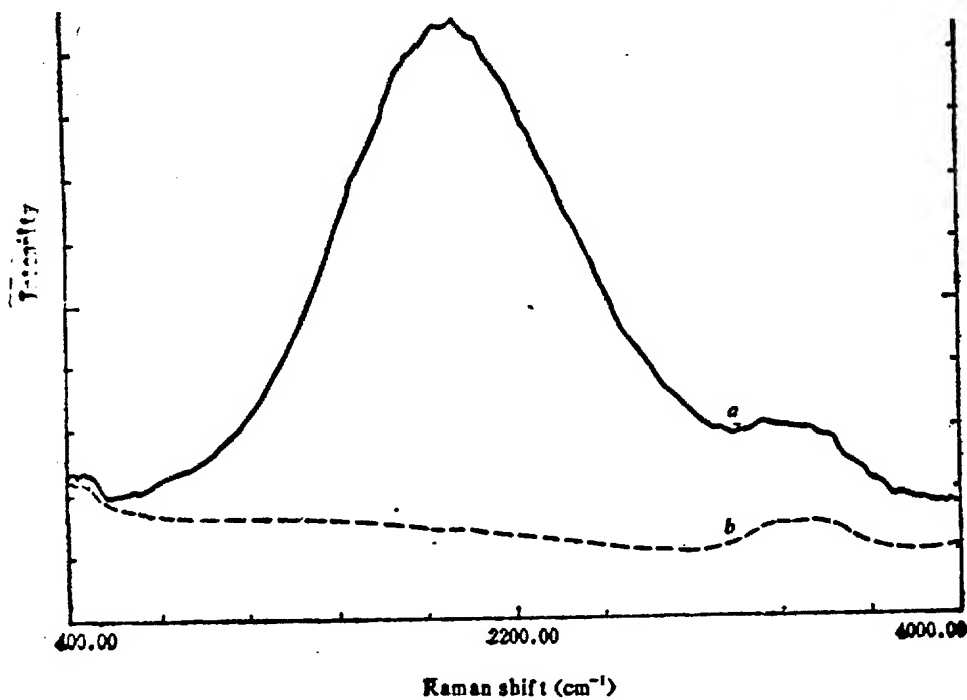


Fig. 5 Raman spectrum Fig. of tap water after external qigong  
 a--0.5 hour after qigong                      b--tap water background before

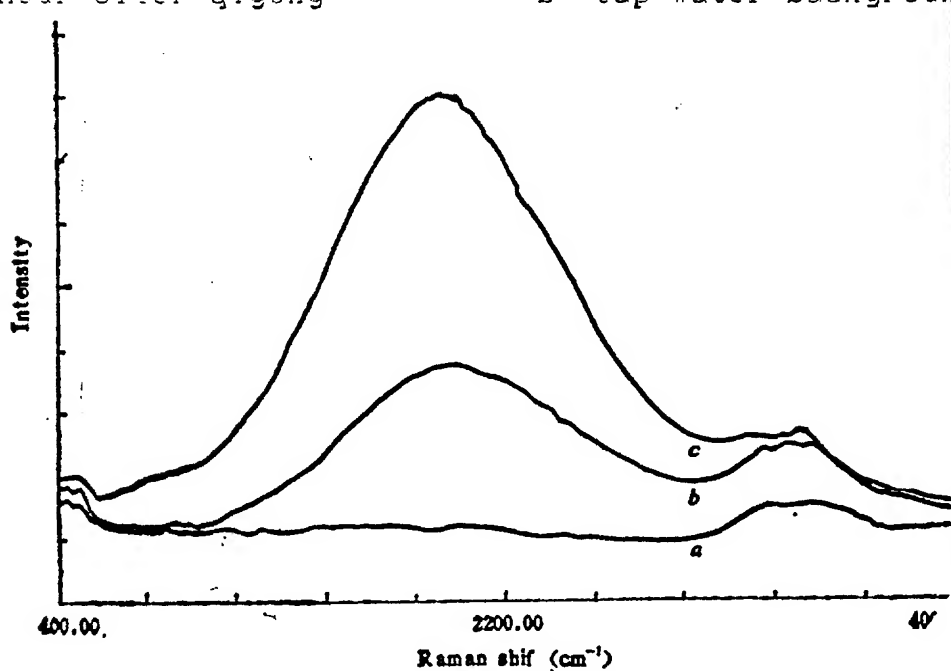


Fig. 6 Raman spectrum trace Fig. of tap water after qigong.  
 c--0.5 hour after external qigong  
 b--1.5 hour after qigong (7km super distance)  
 a--2 hours after qigong.

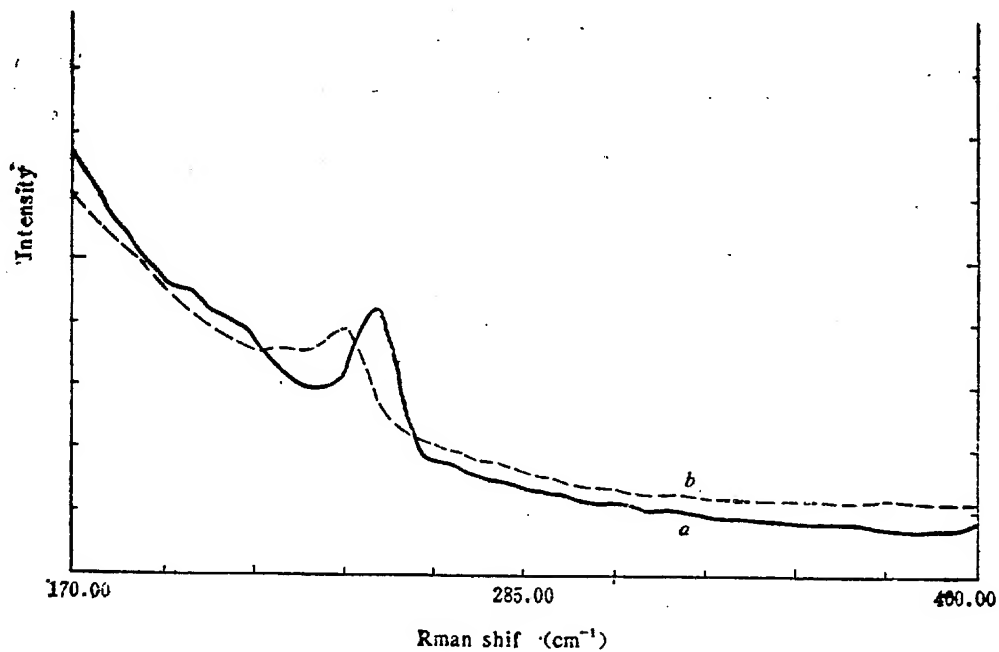


Fig. 7 Raman spectrum diagram of medical 0.9% physiological saline solution.

a--Raman spectrum before external qi (7km distance)  
b Raman spectrum after external qi

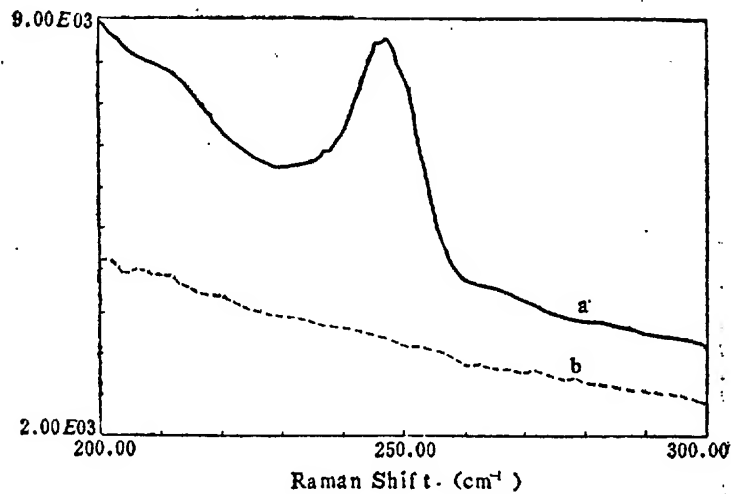


Fig. 8 Raman spectrum of medical 0.9 physiological saline

a--Raman spectrum before external qi  
b--Raman spectrum after external qi

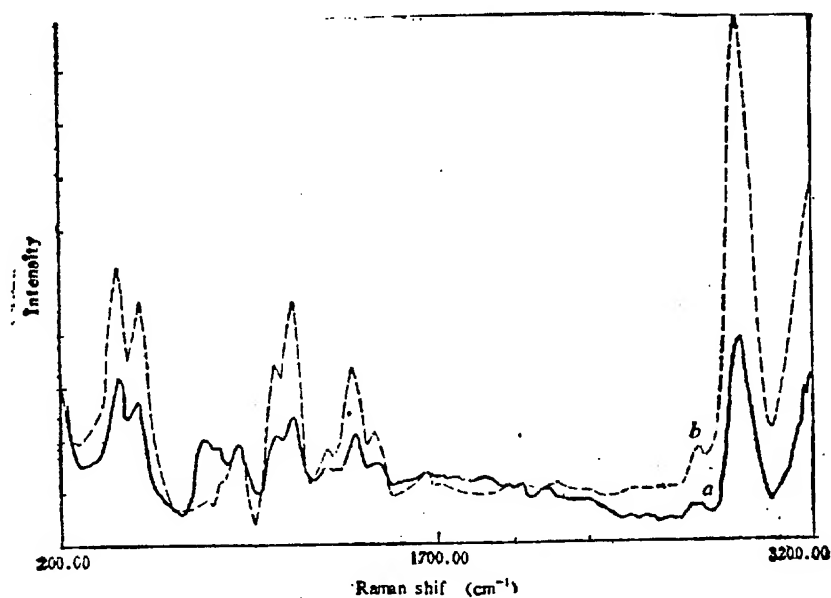


Fig. 9 Raman spectrum diagram of medical 5% glucose solution

a--Raman spectrum before external qi  
b--Raman spectrum after external qi

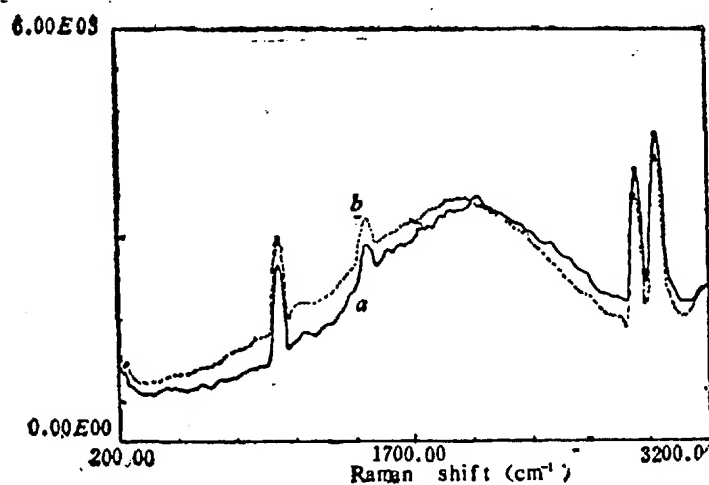


Fig. 10 Raman spectrum of 1.5mg/ml maidimeisu solution

a--Raman spectrum before external qi  
b--Raman spectrum after external qi

The Effects of Qi on the Polarization Plane of a Laser Beam

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Introduction

Experimental surveys on the orientation of the polarized plane of laser emission in the helium neon cavity models show that rotation occurs when Qi is applied.

The application of Qi is credited to Dr. Yan Xin, a Qigong Master. He released energy (Fagong) from a distance of 7 km and 2000 km from the experiment chamber on five different occasions. Experiment results clearly showed that when energy was released, rotation of the polarized plane occurred.

By collating the experiment results, an argument has been put forth concerning the remarkable characteristics of Qi and its long distance applications.

The use of modern scientific and technical methods to conduct research work on Qi has a history of only 10 short years.

Scientific research documentation on Qigong has been done by a pioneer group only in the recent past. This group still needs to discover and promulgate many unknown manifestations of Qigong. Moreover, there is need for future progress in the research and knowledge of the scientific laws of Qigong and the establishment of its phenomenological theory.

These experiments have also been conducted for the above mentioned purpose. They have two aspects.

The first is the observation of the effect of Qi on the stable output of a helium neon capacity laser. We also calculate the working conditions of the laser device as reflected in the orientation of its comparatively sensitive polarization plane, using it as the target of our survey. Qigong doctors, by releasing energy, can cure sick people from a distance. the characteristics of this long-distance action still require clarification through in-depth experiments.

The second is to try and map out the long-distance processes of Qi through testing and verification.

#### 1. Design and Preparation of the Experiment

Planning the experiment has two parts: once concerning the release of energy and the other concerning the experiment

equipment.

In this experiment, the energy release (Fagong) was always undertaken by Qigong Master Dr. Yan Xin. The goal of this experiment was solely to record the long-distance action of Qi. Therefore, we used the method of emitting energy upon a distant target. At first, Dr. Xin emitted energy from 7 kms away. When the experiment was successful, he emitted energy from a distance of 2000 kms

This was the first experiment in the research of Qigong in which energy was emitted from such a remote distance.

Long distance emission of energy is difficult and complex. Before each emission the Qigong Master requires 1-2 days of preparation. Preparation time depends on the distance of emission. Prior to the experiment, the Master undertakes an exploratory survey. He ensures the arrangements are complete, and if not satisfied, can refuse to proceed.

Once the experiment begins he emits energy using the traditional and comprehensive thought methods of Qigong. According to the distance, he must add on the relevant thought and feeling method, expel obstruction method, etc. After the experiment is completed, he must restore himself and replenish expended



energy.

While the experiment is under way all persons must leave the laboratory and shut the door. Only after completion can they enter to obtain experiment data and begin analysis.

## 2. Experiment Preparation

The experiment uses a helium neon inner cavity type laser (Illustration 1) with a power of 2 mW. 20 cm in front of the laser beam tube place a flat mirror. When the normal line of the mirror is clamped on at an angle of about 57 degrees to the incidence of the laser beam, the mirror reflects the components of the incidence of the polarized laser beam as it falls vertically.

This is recorded using a silicon photocell. The photocell must be placed 20 cm from the foot of the mirror.

The polarize plane of the laser beam's angle to the flat surface is . When there is any change on the polarized surface, and rotation occurs, this will be recorded by the silicon photocell because the light strength  $I_p$  of the vertical components will change.

The value of  $I_p$  changes into  $I_p'$ , and the becomes :

the angle of rotation,  $I$ , is the force of the incident beam. The measure of  $I_p$  can then be calculated as the rotation of the polarized plane .

On the other side of the laser tube place another photocell at a distance of 10 cm, Use this to monitor the changed output energy rate of the laser beam.

Illustration 1

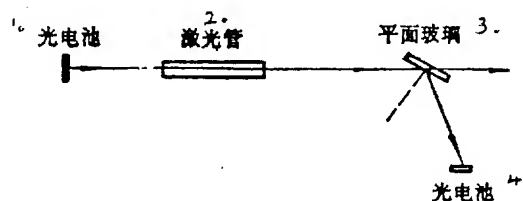


图1 实验装置示意图

1. Silicon photocell
2. Laser Tube
3. Mirror
4. Silicon photocell

The automatic balance recording apparatus of the constant light flow of the two photocells will record anything beyond 4 metres.

### 3. Self disturbances created by the equipment

Rotation of the laser polarized plane can also occur because of the following factors.

(a) Changes in temperature. Differences in ambient temperature

between the inside of the laser tube from which current is being discharged and the outside can lead to changes in the length of the resonant cavity in the laser tube, This can transform the resonance frequency.

In the polarized laser beam produced by the gas cavity type of laser device, each and every longitudinal membrane becomes polarized with linear characteristics. Two neighboring longitudinal membranes in a polarized square are mutually vertical.

The drift jump frequency of the longitudinal membranes causes changes in relative strength between each membrane. This results in the rotation of the polarized surface.

The rotation of the polarized surface is extremely sensitive to temperature changes. For example, in a 30 cm long glass laser tube, if the temperature changes by 0.26 degrees, this can create a jumping membrane, causing rotation. Even the slightest breeze, created by a person walking past, can produce rotation of the polarized surface.

b. Change in gas refraction index. A change in the gas refraction index can also lead to a frequency drift. Due to changes in the discharging current, the gas inside the tube.

can become separated. Changes in pressure can also lead to change in the gas refraction index. In a helium neon laser, however, these changes need not be serious.

The laser tube was in a stable setting before conducting the experiment. No changes were caused by separation of gas or by pressure changes. These difficulties were completely overcome.

We were able to determine through surveys that temperature is the most important factor causing rotation of the polarized plane. Thus we were able to successfully cause rotation through the action of  $Q_i$ . The best method is to project the laser tube in an environment of steady temperature so as not to cause self-rotation of the polarized plane.

The laser tube thus generally should be operated in a stable situation for at least half an hour before energy release. In the 2000 km experiments, energy was released only after the laser had been operating stably for 3 hours.

In order to maintain a completely stable environmental temperature, the experiment equipment was placed in an inner chamber inside the darkroom which was inside the laboratory. before energy emission all personnel must leave the room and

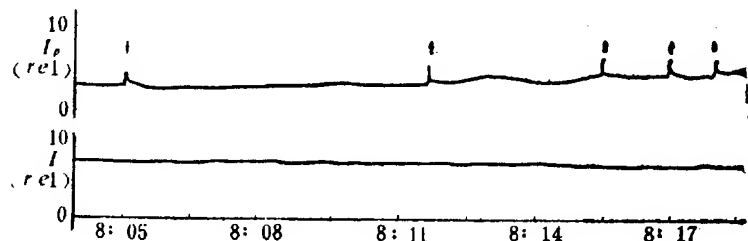
lock the door behind them. Even after emission of the long-distance energy has stopped, human body temperature can cause disturbance in the laser.

While Qi is emitted, the voluntary balance recording instrument can immediately start recording a few inquiry numbers that are reflected. We must start with these numbers and the record wave patterns of the polarized surface.

When Dr. Yan Xin was directly emitting energy to the voluntary balance recording instrument, we recorded the inquiry number waves that came up. These may be seen in Illustration 2. Dr. Yan Xin always used the "expelling disturbance" method to emit energy. In the real survey of every experiment we are still to discover in the record of the wave pattern recordings in Illustration 2 any inquiry numbers which the voluntary balance recorder gave off by itself or which are not caused by the reception of energy release.

### Illustration 2

The inquiry numbers which were recorded when Dr. Yan Xin was directly emitting energy to the voluntary balance recording instrument



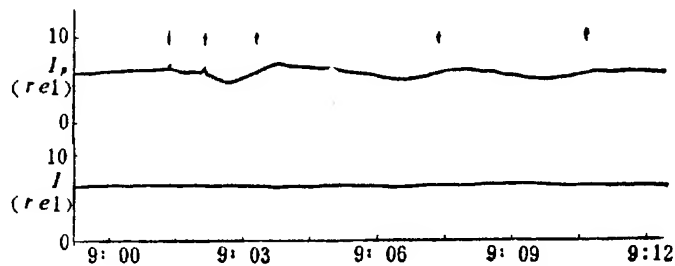


图2 严新直接向自动平衡记录仪发功时记录到的讯号

## 2. The Experiment

The experiment was started at the end of December 1986. Dr. Yan Xin made a number of visits to the laboratory to understand the experiment installations and the site of the laboratory. He conducted one experiment of releasing direct energy on the voluntary balance recording instrument. After that he never again visited the laboratory during the experiment period.

In the one month experiment, we succeeded 5 times in recording a clear undulating change in the  $I_p$  value when energy (Fagong) was released. This was done thrice when the Master was 7 km away and twice when he was 2000 km away. These recordings can be seen in Illustrations 3-5.

Illustration 3 is the result of an energy release 7 km away. While energy was released for a period of 55 minutes, the

previously stable  $I_p$  value 10 times manifested an undulating oscillation. After receiving energy it became even more stable. The  $I_p$  value changed by 10%, equal to a rotation of 6 degrees.

### Illustration 3

The experiment result of a 7 km energy release

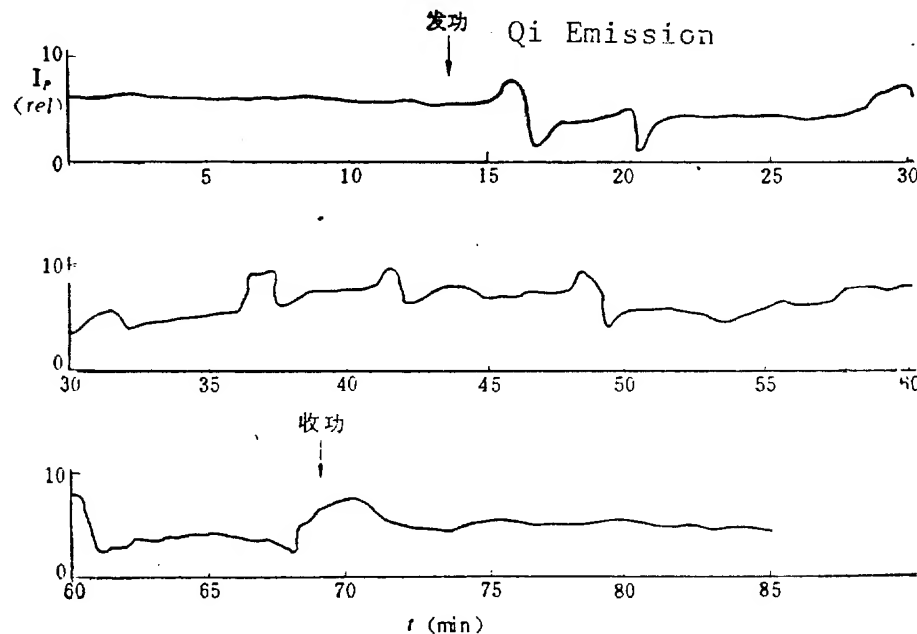


Illustration 4 shows the result of an energy release from 2000 kms away. The illustration shows a recording one hour before energy emission and the stable 1/2 hour after energy was received and the clear polarization disturbance which took

place 6 times in 1 hr 45 min when energy was released. The  $I_p$  wave fluctuation perimeters were 12%, equal to a rotation of 7 degrees.

#### Illustration 4

The experiment result of a 2000 km energy release

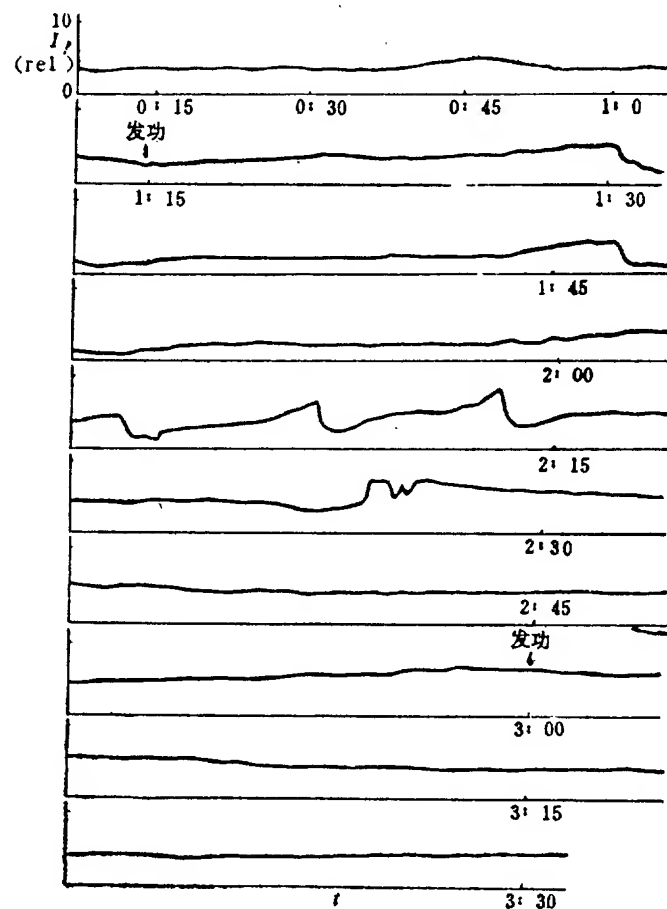


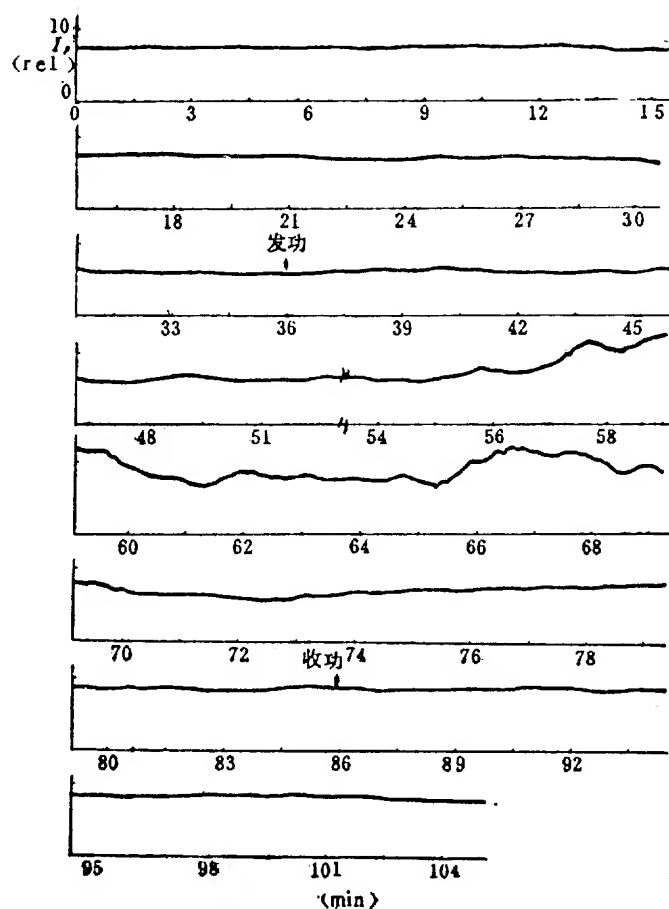
Illustration 5 shows a second result of an energy release from 2000 kms away. the stable  $I_p$  put out a stable fluctuation



of nearly 20 minutes after energy was released. Especially noteworthy was a repeated increase in a category of ripples in big rises of disturbance. Our previous experiment records show that this type of ripple phenomenon is not a product of the laser device's independent action. The fluctuation perimeters of  $I_p$  were 10%, equal to a refraction of 6 degrees.

#### Illustration 5

The experiment result of another 2000 km energy release



In every one of these experiments the laser tube output rate was monitored as being stable. We have thus not drawn the line for this stable work rate.

The above experiments were conducted after eliminating all outside disturbances. thus the results are remarkable and show that when the temperature is stable, the action of Q can cause the polarization plane of a laser to rotate.

### 3. Discussion

1. Here are a few outstanding characteristics of our laser beam experiment records:

To create an accepted scientific concept, it is necessary to consistently duplicate the experiment and the experimental data.

However, the Qigong experiments have been conducted with only a few samples. This is because they all require Qigong Masters. The release of energy (Fagong) depletes 10,000 breaths and the Qigong Master suffers harm to both physical and inner strength. therefore, the Qigong Master is incapable of repeatedly duplicating energy release. When energy is being emitted from far away, the depletion of energy is an especially big problem. Therefore we are left with small sample experiments.

Every time the Master emits energy, the emission is closely linked to his physical, emotional and mental condition, thus making duplication very difficult. It was very hard for us to ensure consistency and duplication for the experiments.

Clearly it was impossible for us to fulfill all the requirements for experiments since we cannot conduct large sample experiments or ensure rigorous duplication. So how can these experiments be considered reliable?

The above conditions needs not be completely fulfilled by the analysis of the results of experiments which aim to discover the effects of Qigong. this is because the immediate goal of statistical analysis at this point is to come up with new discoveries in the course of the experiment so a false impression can only be created by statistical fluctuations in the usual background.

Our reply to the above question utilizes the "Hypothesis Method" which is a study of mathematical statistics. In the method the important thing is the precise understanding of statistical fluctuations in the background. Thus the background is surveyed as the detailed model and not the new manifestations. in these situations one has to discover a few high remarkability

instances to prove the reliable occurrences of new manifestations. Moreover, duplication of the same high reliability instances in every experiment is unnecessary. In recent decades of scientific discovery, particularly in that of basic chemistry, examples like thus are not rare.

Take for example a certain physical quantity  $X$  which is surveyed many times, we get an average value  $\mu$  and a standard error  $\sigma$ . For a certain number of surveys, we get the value  $x^*$  of the significant deviation  $\mu \cdot 0/x^* - \mu / = 5\sigma$ ,  $S$  becomes the reliability of the above sample. When  $S \geq 5$ , we know that the significance of the example has been highly fulfilled. This is because the possibility factor of these examples being created by the background statistical fluctuations is only  $5.8 \times 10^{-7}$ .

Thus we can take these instances as being a confirmation of new manifestations.

Following the same principle, we also came to the conclusion that the rotation of the laser beam polarized plane in our experiments was caused by the action of  $Q_i$ .

2. The long distance action of  $Q_i$  in our experiments clearly contradicts the scientific laws stating there exists a

proportionate ratio between the strength of the long distance and close-up action. This reality is difficult to understand.

In the study of physics, the active strength of gravity and electro-magnetism follows the law of the inverse square ratio. But the mutual strength action or mutual weakness action does not follow this law. The law of inverse square ratios is not the foremost law describing action strength and distance. There are a few physical manifestations, eg., laser beams can pass through a thousand li and still keep their luminosity because of the very tiny divergence angle. Similarly, it is not impossible that Qi can go through 2000 kms and still maintain its action strength.

The existence of the above-mentioned long-distance action of Qi, there are various other characteristics like its intense piercing characteristic, acting on more than one target, and two-way regulation, etc. that cannot be explained by modern physical science theories. Clearly Qigong science goes beyond modern scientific knowledge. Under the restrictions of today's level of scientific development, the characteristics of Qi remain to be verified and its laws have been delved into only slightly.

Under these conditions, to determine the genuineness of Qigong manifestations has taken great determination on our part because we have had to employ a simple "yes or no" method to conform to modern scientific theories and regulations.

## The Effect of Qi on the Phase Behavior of Liposomes

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### Introduction

This article studies the effect of Qi on the phase behavior of liposome (artificial membrane). research was conducted using a differential scanning calorimeter. Results show that apart from the original phase deviations of liposomes at over 41.5 degrees C, under the action of Qi they undergo an enormous endothermic step at around 46-48 degrees C. Moreover, this endothermic step is related to the catabolism of the phosphatidic choline on the extreme tip of DPPC into phosphoric acid coalmine.

In the course of this experiment Dr. Yan Xin used the long-distance energy release method and that the farthest target was around 9 kms away.

To determine the action of Qi on a bio-membrane, as a first step we used a differential scanning calorimeter to study the effect of Qi on the phase behavior of DPPC (Dipalmitoy Phosphatidic Choline) liposomes (artificial membranes).

### 1. Materials

The DPPC was a product of the American Sigma Corporation. The 1090B model thermal analyzer was the product of the American DuPont Corporation. The thermal flux measurement accuracy was 1 mw/cm.

Preparing the DPPC liposome. We placed an accurate measurement of 2 mgs of phosphatide in a test-tube. We added 100 ml of buffer liquid (140mm NaCl, 5mm  $\text{NaPO}_4$ , pH 7.4). After the phosphatide was disintegrated in a vortex oscillator, it was further oscillated to become a turbid floating liquid in a 50 degrees C water-bath type of ultrasonic generator.

### 2. The Experiment Step by Step

After the liposome samples were properly prepared, 10 ml of the sample was extracted by microsyringe and injected into



an aluminum specimen case. We then proceeded with the DSC survey.

During the 4 hours or so from the point when the specimens were ready to the time when the experiment started, the specimens were examined 3 times.

To act as a contrast, the liposomes had one transformation point of 41.5 degrees C when they changed from gel form to liquid crystals. The survey results showed that the apex did not transform and the specimen was stable.

After this the surveyed sample was subjected to an energy release period. Dr. Yan Xin released energy for 5-10 minutes. After this, the sample was sent to the laboratory for testing and its DSC curve was recorded.

During the experiment Dr. Yan Xin avoided all physical contact with the samples. After being surveyed, the sample once again was subjected to an energy release period by Dr. Yan Xin, after which it was again tested in the laboratory and its DSC curve recorded for the second time. This was repeated 2-3 times with every specimen.

The DSC scanning perimeters were 20-60 degrees C, and the rate of temperature rise was 2 degrees C/minute. A micro-machine

control program was used to record and process data.

### 3. Energy Release Method

Apart from directly releasing energy on the specimen, Dr. Yan Xin also used the long-distance energy release method. During this period, the specimen was 7-10 kms away and radio contact was used to arrange timings.

### 4. The Experiment Results

These experiments tested a total of 5 specimens and energy was released 11 times. Energy was directly released on the subject twice, from 20 meters once, from 3 kms twice, and from 9 km 6 times.

Survey results for each time were astonishing. Moreover, these results did not merely incorporate the long-distance effect. See Table 1 and the survey results of specimens 1# and 2#.

All the surveys, without exception, show that after energy emission, apart from the original transformation peak of the DPPC at 41.5 degrees C, there was also an enormous endothermic step at around 46 degrees C. The thermal flux value is over 10 times greater than the peak value of 41.5 degrees C.

We conducted a 6 day long tracing on specimen #1, and basically

its DSC curve appearance did not change (Graph 2).

## 5. Discussion

### A. The stability of DPPC liposomes.

The most important question considered in this experiment is whether the instability of DPPC causes the endothermic step at 46 degrees C.

DPPC is a comparatively stable phospholipid. In the research of all membranes, it is often used in the preparation of liposomes acting as model membranes in the study of the structure and functions of cell membranes.

We increased the flourescein calcium yellow green primary contained in the DPPC liposome. If the liposome, due to restrictions etc. caused the membrane to have defects, these would have shown up through a flourescein leak. Such leaks can show if a liposome is stable. During our 9-month long survey, we have never observed any evidence of flourescien leaks.

The experiment period never extended beyond 5 hours. Calculating from the time that the specimen was prepared, it never extended beyond 12 hours. Thus, instability of the liposome is completed ruled out.

After the first time the liposome received energy, the endothermic step was situated at 46 degrees C. But after the second time it further increased to 51 degrees C. Since we scanned specimen 1# for 6 days, we know that the endothermic step is comparatively stable and it is impossible to jump it 5+ degrees C in a short time. This authenticates Qi action.

B. A thorough examination of the endothermic step.

All scientists conducting research on liposomes know that if the DPPC does not manifest a catabolic appearance, its molecular structure is preserved.

Therefore, if its transformation point is 41.5 degrees C, it cannot come up with another transformation peak.

So if an enormous endothermic step occurs at 46 degrees C, the DPPC molecular structure is undergoing various changes. For example, a catabolic manifestation at its extreme tip, or a break in the link of its fatty acid chain, or the production of an independent base.

Using thin-layer chromatographic analysis technology, we analyzed specimen 1# which led to a particularly enormous endothermic step. we discovered that the phosphatidic choline (PC) on the extreme end of the DPPC catabolized and the choline

((CH<sub>3</sub>)<sub>3</sub>N(OH)CH<sub>2</sub>CH<sub>2</sub>OH)) becomes Phosphadatic Ethanolamine  
(PE; NH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH).

### Note of thanks

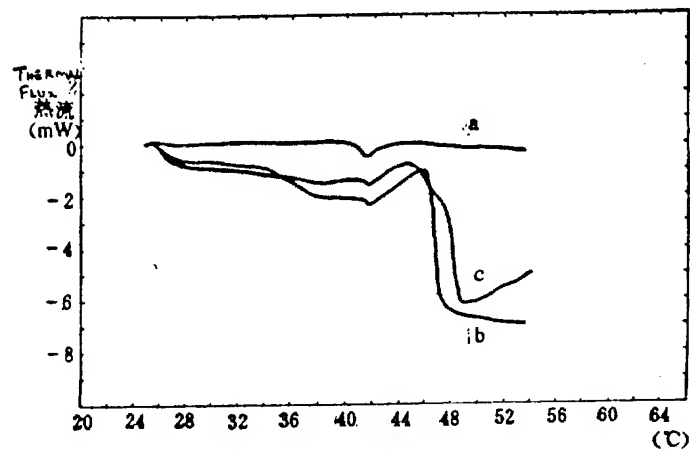
We are extremely grateful to Shen Shu Min, Biophysics Research Department of the Chinese Academy of Sciences; Prof. Zhan Fengyu for his beneficial suggests; Prof. Bao Fengfu and Comrade Che Chenwu for their thin-layer chromatographic analysis.

Table 1: The DSC Value Curve of Specimens 1#, 2#, & 3#

1*, 2*, 3* 样品的 DSC 曲线值 表 1					
i. 样品情况	测量时间	5 相变温度 °C	4 吸热台阶		
			5 峰位 °C	6 宽度 °C	
1 本底	8 刚制备后	16:00	41.4		
	9 五小时后	21:03	41.6		
	10 分为三个样品 1#	23:33	41.5		
	2#	0:11	41.7		
11 第 x 次发功后		12 平均 41.55 ± 0.08			
1 #	1	0:33	41.6	48	6.4
	2	1:18	41.6	49	7.4
2 #	1	1:48	41.7	46-48	4.3-6.3
	2	4:05	41.7	51.5	9.8
3 #	1	2:09	41.7	47	5.3
	2	3:09	41.6	47.5	5.9
	3	3:30	41.7	49.8	8
平均 41.66 ± 0.05					
1 #	13 当天 1:18	41.6	49		
	14 次日 10:30	41.6	48.5		
	15 第 6 天 10:45	41.6	48		

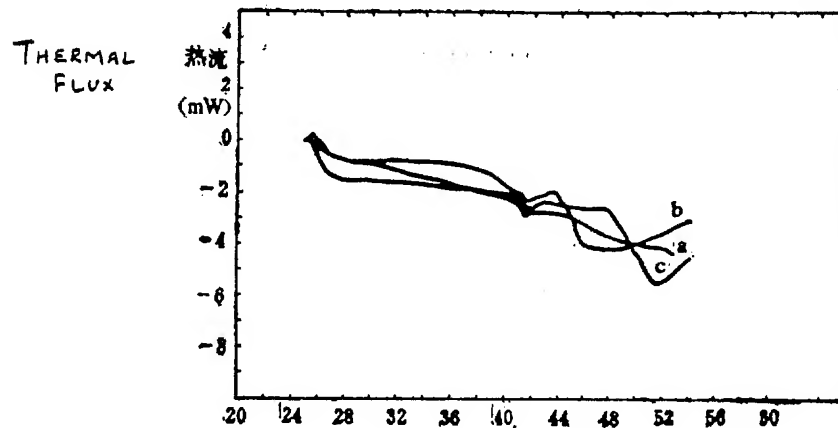
1. The specimen conditions
2. Survey period
3. Contrast timings
4. Endothermic steps
5. Peak
6. Fall
7. Background
8. Immediately after preparation
9. After 5 hours
10. The 3 separate samples
11. The energy emission time
12. Average
13. That day
14. Next day
15. 6th day

Illustration Ia: The DSC curve of Specimen 1#



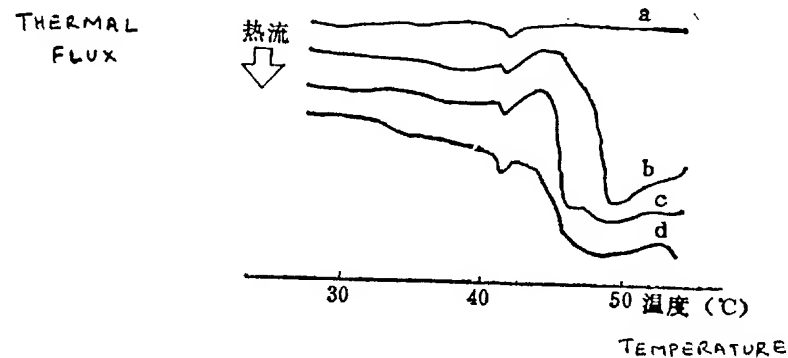
- a. Contrast
- b. After 1st energy release
- c. After 2nd energy release

Illustration Ib: DSC curve of Specimen 2#



- a. Contrast
- b. After 1st energy release
- c. After 2nd energy release

Illustration II: DSC curve of Specimen 2# after 6 days



- a. Contrast
- b. After energy release
- c. 33 hours after energy release
- d. 6 days, 9 hours, 37 minutes after energy release

The Hyperchromic Effect of Nucleic Acid Solution Induced by Qigong

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Introduction

This paper documents the action of on calf pleura DNA and yeast RNA. Under the action of Qi, the ultraviolet absorption value of 257 nm of nucleic acid solution rose dramatically. it produced a "Hyperchromic effect which is normally produced after the hydrogen bond breaks in the DNA double-helix chain. The hyperchromic effect of the DNA ultraviolet solution was maintained for at least 9 hours after the Qi action.

A comparatively mathematical statistics solution was given to the experiment results.

A special feature of the experiment is that Dr. Yan Xin emitted energy 3-10 kms away from the sample. To investigate what Qi can manifest in the macromolecules of organisms we measured the changes in the ultraviolet absorption value of calf pleura



DNA and yeast DNA solutions.

### 1. Materials and recording Instruments

The calf pleura DNA was a product of the Biochemical Reagent Factory of the Biophysics Research Department, Chinese Academy of Sciences. The yeast RNA was a product of the Shanghai East Wind Biochemical Reagent Factory. The above mentioned specimens were dissolved in deionised water. In order to eliminate other factors, no acid or alkali were added to the solution. The solution was put in a centrifuge to eliminate undissolved water, and then put away inside a freezer.

To survey the ultraviolet absorption, we use the Swiss KONTRON Vvikon 860 Model automatic recorder which can scan at a fast speed. This visible light spectrophotometer can continuously scan a 220-320 nm wave-length range. The scanning speed is 1000 nm/minute, and the measurement accuracy is  $\pm 0.001$ .

### 2. Experiment Steps and Energy Emission

We took 2 ml of nucleic acid solution, placed it in a quartz absorption cell and covered it. At room temperature, Dr. Yan Xin emitted energy on the specimen for 10-15 minutes. The difference before and after energy emission was determined through the ultraviolet absorption of the nucleic acid.

A total of 5 DNA samples were used and energy was emitted

15 times. The long-distance method was used each time, thrice from 3 km away, and 12 times from around 10 kms away.

Two RNA samples were used and energy was emitted on them 6 times. Four times Dr. Yan Xin emitted energy from right next to the specimen and twice from 6 kms away.

When the Qigong Master emitted energy from a long-distance, he fixed the emitting energy and the receiving energy periods with us via telephone.

It was the tester's responsibility to put the specimens in an energy emission period and to send them to be measured. Dr. Yan Xin did not take any part in the preparation, movements, and measurements of the samples.

### 3. Experiment results

#### A. The DNA Specimens.

In the two hours before energy emission, we scanned the ultraviolet absorption measurement of the specimen every 20-30 minutes. The result was stable (Table 1 & Illustration 1).

The following are the experiment results of specimens 4-2#, 3-2#, and 4-4#.

Specimen 4-2# The absorption value before energy emission was 0.4225 plus/minus 0.0006. After the second energy emission, the absorption value rose in 50 minutes from 0.428 to 0.434,

a value of 2.8%. After the third energy emission it rose to 0.441, increasing by 4.5%. the contrast 4-3# specimen's value of 0.423 did not change. Energy emission on the contrast specimen was delivered from roughly 15 km away.

Specimen 3-2#. Its low absorption value was stable at 0.517 +/- 0.0002. After the first energy emission it rose to 0.529, and after 45 minutes of energy emission it rose to 0.539. After the second and third times which went on for 9 hours in all, the absorption value rose to 0.579, increasing by 12%. The contrast specimen placed in the capacity flask still had the same absorption rate of 0.517.

Specimen 4-4#. This specimen was placed inside a small lead pot (inside radius 28 mm, outside radius 48 mm) adjacent to specimen 4-2#. After it had been subjected to energy emission thrice, its absorption rate rose from 0.424 to 0.435, increase by 2.6%. Thus, the lead pot cannot entirely screen Qi action.

In every experiment, the room temperature was maintained between 16-18 degrees C.

B. The RNA Specimen. The absorption value of specimen 4# rose from 1.831 to 1.918 after energy was emitted three times, showing an increase of 4.8%. That of specimen 2# rose from 1.831 to

1.855, i.e., by 1.3%. Two hours before testing, the absorption value of the specimen was  $1.861 \pm 0.011$ . (Table 2 & Illustration 2). The room temperature was 16-18 degrees C.

#### 4. Discussion - The Experiment's Reliability

In the above experiment, 5 DNA samples were used and energy emitted 5 times. in a small model experiment, proof of result reliability is needed.

The Qi experiments rely on energy emission by a Qigong Master which depletes his Qi element. The number of emissions must be limited, making the experiments small model experiments. Moreover, there can be no precise duplication of the emissions.

Therefore, how are these experiments to be relied on?

We all know that research work of discovering new manifestations is divided into two phases. The first is to make the discovery of new manifestations of an experimental goal. The second is to explore the regularity of the new manifestations. the statistical remarkability question which comes up in the experimental results in the first phase can be answered by the often used "remarkability examination" method of mathematical statistics.

The size of the significance level "a" of an abnormal result in an experiment determines whether new manifestations have

been discovered or the abnormal result is merely a statistical fluctuation in the constant background. If "a" manifests in a situation where no new manifestations are being discovered, then it represents only statistical fluctuations. So we can say that the smaller "a" is, the greater the possibility that new manifestations exist.

Take a certain physical measurement "x", its average value is  $\mu$ , and its normal fault is  $\sigma$ . One significant value  $x^*$  is calculated as deviating from  $\mu$ .

This value's significance

$$S = \frac{(x^* - \mu)}{\sigma}$$

and its significant average

$$a = N(x^*, \mu, \sigma^2)$$

$N(x, \mu, \sigma^2)$  is the distribution function of the normal distribution. then assuming that "x" is following the normal distribution situation, then

$$\frac{(x^* - \mu)}{\sigma} \quad S$$

approximation rate arises. If

$$S = 5 \text{ times, } a = 5.8 \times 10^{-7}$$

$$S = 6 \text{ times, } a = 2 \times 10^9$$

If we are using the significance test method to determine new manifestations, it is important to first completely and

precisely comprehend the background fluctuations. The determination of the existence of new manifestations only requires the significance of the "abnormal example" to be sufficiently high and it is not necessary to find very big experimental models because small numbers of a few high significance examples can fit the bill.

The same significance does not need to be found in each and every example, so it is not necessary for the energy emission strength of the effect it has to be exactly alike every time.

Therefore the experiments that we have listed above fall into the category of the new manifestations caused by the effect of Qi because they coincide with the significance determining tests.

This example was to measure the ultraviolet absorption of DNA (257 nm) and to determine whether it can transform due to the action of Qi. It is then necessary to have an exact understanding of the new factors which could affect 257 nm absorption of DNA. denaturation of the nucleic acid can cause an absorption increase at 257 nm which can be called the "Hyperchromic Effect". the nucleic acid denaturation can point to a break in the double-helix chain structure or a snap in

the hydrogen bond (but not to be related to breakage in the covalent bond between nucleotides), which are important biochemical characteristics of nucleic acid (1).

Factors that can cause nucleic acid denaturation are as follows:

(a) Thermal denaturation: generally speaking, thermal denaturation starts at 77 degrees C. the fusion temperature for calf pleura DNA denaturation is around 85 degrees C. in our experiment, the temperature was less than 18 degrees C at the time of energy emission (10-15 minutes) measurement (not more than 1 minute at a time) and when the specimen was kept in the laboratory. Therefore thermal denaturation could not have taken place.

(b) Denaturation caused by the addition of some acid, alkali, or even some organic solvent. In the course of our experiment, no acid, alkali, or organic solvents were added. Therefore the above mentioned factors leading to denaturation did not exist.

(c) the effect of calf pleura purity: All the specimens used left the factory with an index saying that the molecular weight was  $1 \times 10^7$ , DNA purity was 90-95%, and the only other important impurity was protein. The biggest ultraviolet absorption value of protein is at 280 nm. Moreover, its content as compared

to that of the DNA was one weight grade less. Therefore the absorption value of the DNA at 257 nm cannot be considered as being disturbed by the protein.

The background absorption value of specimen 3-2# averages 0.517 +/- 0.002,  $\theta = 0.002$ . the maximum increase after energy emission is 0.063,  $s = 31.5$ ,  $a \ll 2 \times 10^{-9}$ .

The average absorption value of specimen 4-2# averages 0.4225 +/- 0.0005, maximum increase after energy emission is 0.018,  $s=30$ ,  $a \ll 2 \times 10^{-9}$ .

The experiment results were highly surprising. In the action of Qi, both DNA and ANA (Translator's note: the term ANA is not a translation error) manifested different degrees of ultraviolet absorption hyperchromatic effect as caused by the snapping of the hydrogen bond.

#### Reference

(1) Sheng Tong, Wang Jingyan, Zhao Banti editor, Biochemistry, Chapter 4; People's Academic Publishing House, 1980.

(Tables start next page)



Table 1a

The UV Absorption of the Calf Pleura  
DNA of Samples 4-2#, 4-3# and 4-4#

样 品 时 间	4-2 *				4-3 *				4-4 *			
	吸 收 曲线号	257 nm 吸收值	吸收 增值	增加 比例 %	吸 收 曲线号	257 nm 吸收值	吸收 增值	增加 比例 %	吸 收 曲线号	257 nm 吸收值	吸收 增值	增加 比例 %
14 本 底												
18:13	3301	0.422			3401	0.424			3501	0.424		
18:40	3601	0.422										
19:00	3602	0.423										
19:30	3603	0.423										
15 平均		0.4225 ± 0.0006										
16. 发功后测量												
17. 第一次发功 (19:30—19:45)												
20:00	3701	0.422			3801	0.423			3901	0.423		
18. 第二次发功 (20:30—20:45)												
21:10	4001	0.428	.005	1.3	4101	0.423			4201	0.427	.003	
21:30	4301	0.434	.011	2.8	4401	0.423			4501	0.430	.006	
22:00	4601	0.434	.011	2.8	4701	0.424			4801	0.431	.007	1.7
19. 第三次发功 (22:10—22:30)												
22:30	4901	0.441	.018	4.5	5001	0.423			5101	0.435	.011	2.6

20. 注: 1. 三号样品为对照样品。距二号样品约 15 m。

2. 四号样品放在小铅罐内。小铅罐: 内径为 28 mm, 外径为 48 mm, 高 130 mm。挨着二号样品。

- |                               |           |
|-------------------------------|-----------|
| 1. Specimen/measurement time  | 7. See 3  |
| 2. Absorption curve numbers   | 8. See 5  |
| 3. 257 nm absorption value    | 9. See 5  |
| 4. Absorption increased value | 10. See 2 |
| 5. The increase proportion %  | 11. See 3 |
| 6. See 2                      | 12. See 4 |

13. See 5  
 14. Background  
 15. Average  
 16. Measurement after energy emission
17. 1st energy emission  
 18. 2nd energy emission  
 19. 3rd energy emission

20. Note 1: The No. 3 specimen is the contrast specimen. The distance of the No. 2 specimen is ~ 15 m

Note 2: The No. 4 specimen is placed inside a small lead flask of inner radius 28 mm and outer radius 48 mm, and height 130 mm. It was placed next to No. 2 specimen.

Table 1 (continued)

21. 样品 22. 时间	1-2			
	23. 吸收曲线号	24. 257 nm 吸收值	25. 吸收值	26. 增加比例%
27. 本底				
18:00	9701	0.515		
18:30	9702	0.516		
19:00	9703	0.518		
19:30	9704	0.520		
20:00	0201	0.517		
	28. 平均	0.517	±0.002	
29. 发功后测量				
30. 第一次发功 (20:10—20:20)				
20:30	0501	0.529	.012	2.3
21:15	1001	0.539	.022	4.3
31. 第二, 三次发功 (21:35—21:45, 22:30—22:40)				
22:40	1301	0.537	.020	3.9
	1601	0.538	.021	4.1
32. 次日 7:40	1901	0.579	.063	12.0
33. 再测原容量瓶中样品本底				
34. 次日 7:40	2201	0.517		

- |                               |   |
|-------------------------------|---|
| 21. Specimen                  | 29. After energy emission   |
| 22. Measurement time          | 30. First emission  |
| 23. Absorption curve          | 31. 2nd & 3rd energy emission   |
| 24. 257 nm absorption value   | 32. Next day  |
| 25. Absorption increase value | 33. The background of the specimen measured once again in the original capacity flask |
| 26. Increase proportion %     |   |
| 27. Background                |   |
| 28. Average                   | 34. Next day  |

Table 2: The UV absorption of yeast RNA Samples 4# & 2#

测量 时间	样 品	Yeast RNA 4#				Yeast RNA 2#			
		曲线号	257nm 吸收值	吸收 增值	比例 %	曲线号	257nm 吸收值	吸收 增值	比例 %
15:00		7301	1.831			7301	1.831		
19:55						7801	1.831		
11 第一次发功									
20:00—20:15		7701	1.861	0.030	1.6				
12 第二次发功									
20:45—20:50		8001	1.891	0.060	3.2	8101	1.867	0.036	2.0
13 第三次发功									
21:20—21:30		8301	1.906	0.075	4.1	8401*	1.867	0.036	2.0
8:21(next day)		8701	1.918	0.087	4.8	9101	1.855	0.024	1.3

14 \* 15' 内重复测量三次均得 1.867

- |         |  |
|---------|--|
| 1.      | Sample   |
| 2.      | Measuring time   |
| 3 & 7.  | Curve  |
| 4 & 8.  | Absorption Value at 257 nm   |
| 5 & 9.  | Absorption Value increase  |
| 6 & 10. | Proportion %   |
| 11.     | First energy emission  |
| 12.     | Second energy emission   |
| 13.     | Third energy emission  |
| 14.     | The repetition of measurement 3 times within 15 feet gave an average of 1.867. |

Table 2 (continued): The stability of yeast RNA

15. 时 间	16. 曲 线 号	17. 平 均 值
2.26 09:21—11:26	9401—9410	1.861±0.011

18. 每 15' 测量一次

- 15. Time
- 16. Curve numbers
- 17. Average value
- 18. Measured once every 15 feet

Illustration 1a: The UV absorption changes of the calf pleura DNA samples 4-2# after energy emission

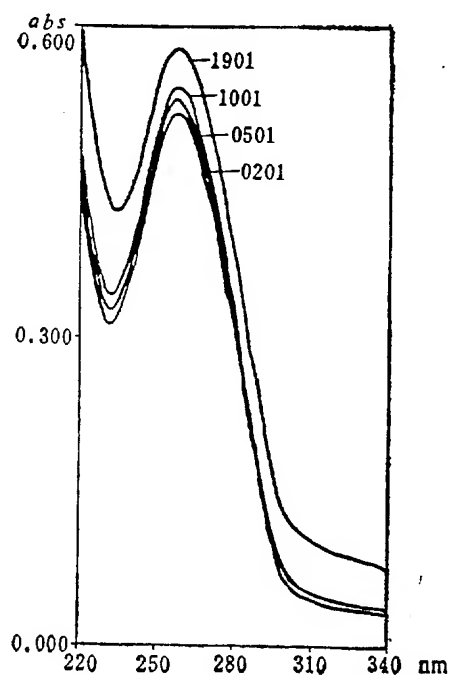
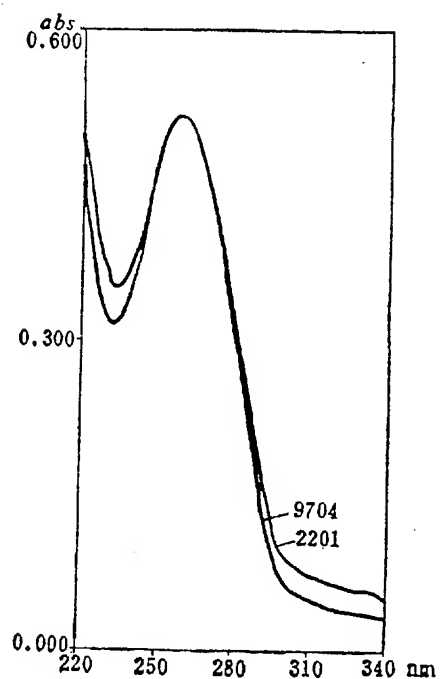
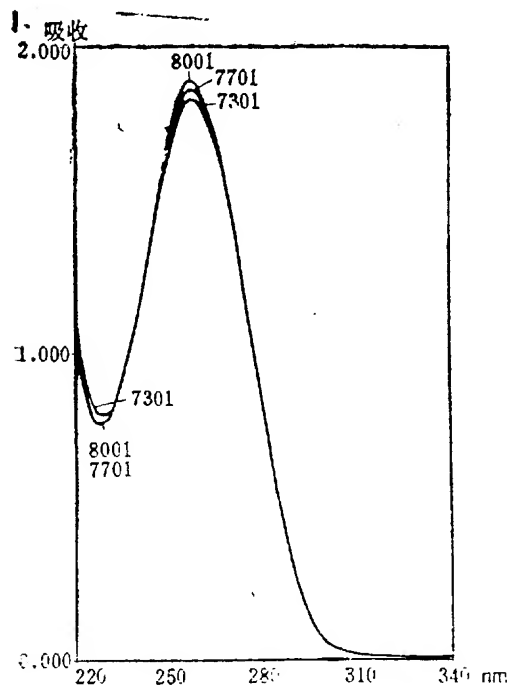


Illustration 1b: The absorption curve of the contrast specimen



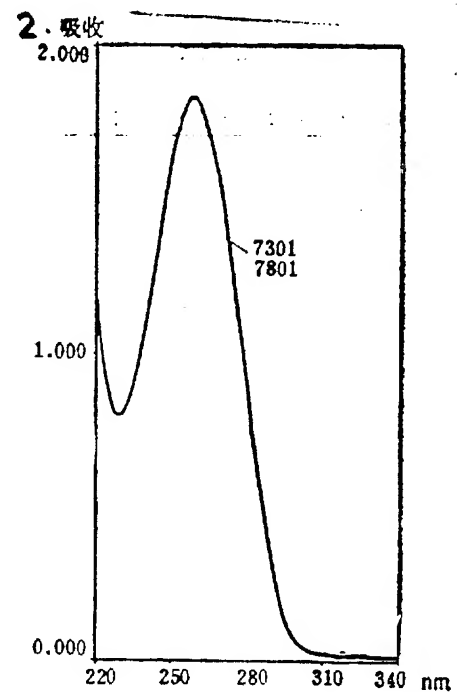
(Continued next page)

**Illustration 2a**  
The UV absorption changes of  
yeast RNA specimen after energy  
emission



1. Absorption

**Illustration 2b**  
The absorption curve  
of the contrast  
specimen



2. Absorption

The Disproportion of CO & H Mixture Induced by Qigong

- Yan Xin (Chongqin Research Institute of Traditional Chinese Medicine)
- Li Shengpin et. al. (The Qinhua University, Department of Chemistry)
- Liu Zuyin (Department of High Energy Physics, Chinese Academy of Sciences)

Summary

A compound mixture  $H_2:CO:N_2 = 1:1:1$  gas was placed in an infrared gas cell at 30 units of atmospheric pressure. Energy was emitted by a Qigong Master from a distance of a few tens of meters to 1900 km under conditions where no catalyst was used and the room temperature was 10-13 degrees C. testing was then proceeded with a Boliye" alternate infra-red device, and it was discovered that carbon-dioxide had already been created.

The contrast experiment showed that under conditions in which there is no catalyst and room temperature is constant, it is not possible for the compound gas system to create carbon-dioxide when Qi is not used. Up to now, there have been no reports seen about the above-mention effects of Qi.

## 1. Introduction

Previous experiments conducted on the physiological effect of Qi on solutions shows that Qi produces certain reliable effects on solutions containing in ions or organic solutes). In order to have an even more widespread understanding of the various effects of Qi, we conducted a few experiments on compound gas systems.

The compound gas system we used ( $H_2+CO$ ) is a very simple material having basic origins in the organic chemistry industry. But in the research of monocarbons, it holds a very important position. Therefore our experimental research on the effect of Qi on this compound gas system not only gives meaningful data on the research of Qigong science, but also gives some pointers to research work on carbon chemistry.

## 2. Experiment Design and method

The equipment used in these experiments was manufactured by the Nicolet Company, namely the 5DX "Boliye" alternative infra-red spectrum machine. The compound gas system used was made at a ratio of 1:1:1 of the materials listed below.

Nitrogen Gas:- Highly pure nitrogen gas, containing 99%  $N_2$ , produced by the Beijing Oxygen Factory.



Hydrogen Gas:- Highly pure hydrogen gas, containing 99%  $H_2$ , produced by the Beijing Oxygen Factory.

Carbon Monoxide:- 99% CO content, provided by the Beijing Chemical Industry Research Department.

The normal position infra-red cell (called the infra-red cell for short) was the type used by the Catalyst Teaching and Research Station, Department of Chemistry, Qinhua University. It has a rust-proof metal body and NaCl salt board. It is capable of withstanding high temperatures of 250 degrees C and 250 atmospheric pressures. The compound gas is filled between the 2 NaCl salt boards and the distance between them is around 1-2 mm.

Experiment Design Generally the production of a chemical reaction in compound gas requires a catalyst and a temperature of several hundred degrees. Thus for the Qigong Master to produce energy that would begin to affect this gas mixture requires a tremendous amount of his power. Therefore in a fixed period of time this experiment can be conducted only a few times, and unlimited duplications are impossible.

Simultaneously, due to the fact that the energy emissions require the physical strength of the Qigong Master and that

his mood can be affected by the environment, it is impossible for the resulting  $Q_i$  to be identical for every emission.

Therefore it is important to fully understand the background conditions of each experiment and conduct an in-depth survey on the two contrasting sides of each experiment. Only then can one hope to achieve precision in the method of measuring the effect of  $Q_i$  on the compound gas specimens.

### 3. Specimen Survey Method

The transformation conditions of the compound gas inside the infra-red cell had to be surveyed. therefore, a different spectrum testing method was used to eliminate the follow-up effect of air on the gas inside the cell.

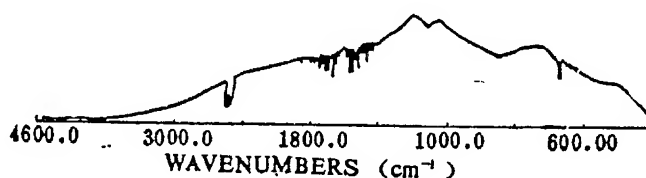
This different spectrum method is as follows:

Before each experiment, we took the air inside the infra-red laboratory as the background and entered its data into a calculator. A model of the air background is shown on Illustration 1. (See next page.)

After this the infra-red cell is filled with the compound gas is placed inside the laboratory and surveyed. The calculator can then automatically conduct a "different spectrum" analysis between the infra-red spectrum of the background and that of

### Illustration 1

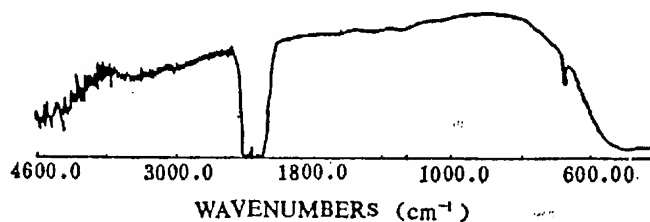
The Infrared Spectrum of Air. Room temperature = 13 degrees C. Light flux = 22,000 lumens



the gas compound. This gives us a clear specimen chart which was then stored inside the calculator. This compound gas spectrum model is shown in Illustration 2.

### Illustration 2

The compound gas spectrum inside the normal position infrared cell after the "different spectrum". Room temperature is 13 degrees C. Light flux is 7000 lumens.



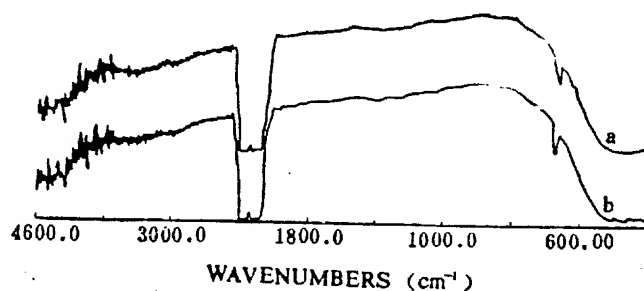
In each experiment, the background and specimen need to be surveyed before and after the experiment. The scanning interval between the two should not be more than 10-15 s. It is then possible to ensure elimination of the effect of air.

During the course of the experiment a random test must be done on the already known specimens to ensure their constant stability. In this way, all suspicions about the Qi effect recordings are eliminated.

Contrast Experiment. In order to eliminate the possibility that the compound gas is capable of automatically creating certain transformation inside an infra-red cell, we prepared an identical compound gas ( $H_2:CO:N_2 = 1:1:1$ , atmospheric pressure = 30 units) and placed it inside an infra-red cell in our laboratory. We kept it for one week in conditions where it was not receiving any Qi. We tested it many times and thus proved that if compound gas is placed inside an infra-red cell, it remains stable and does not manifest any changes that can be tested. The spectrum model of this can be seen in Illustration 3.

### Illustration 3

The compound gas exists in a stable state inside the infrared cell.



- a. the infrared spectrum of the compound gas inside the infra-red cell before cycle 1
- b. The infrared spectrum of the compound gas inside the infrared cell after cycle 1

#### 4. The Qigong Experiment Method

Before the experiment we blew  $N_2$  into all the pipes of the infra-red cell, causing  $N_2$  to fill the cell. Next, we blew the compound gas ( $H_2:CO:N_2 = 1:1:1$ ; atmospheric pressure = 30 units) into the infra-red cell, filling it. Finally, using the above mentioned "different spectrum" method, we tested the infra-red spectrum of the specimen.

Five minutes before energy emission, the experiment personnel

locked the infra-red cell inside the laboratory. Then Dr. Yan Xin emitted energy for 5-15 minutes. After which the cell was taken out for testing. The "different spectrum" method was used. At the same time, random checks were made on the standard specimen to ensure that the tests were constant.

The spectrum of the compound gas was then compared with the above-mentioned specimen spectrum.

This experiment was conducted 6 times. (Results: Table 1)

Table 1

Condition of the compound gas experiment

1. 实验序号	2. 实验内容	3. 室温℃	4. 联络方式	5. 发功距离	6. 实验效果
1986.12.22	H <sub>2</sub> +CO	13		3m	出现CO <sub>2</sub>
1987.1.5	H <sub>2</sub> +CO	13	电话	7km	出现CO <sub>2</sub>
1987.1.8	H <sub>2</sub> +CO	11	电话	7km	出现CO <sub>2</sub>
1987.1.9	H <sub>2</sub> +CO	11	电话	7km	出现CO <sub>2</sub>
1987.1.12	H <sub>2</sub> +CO	10	电话	1900km	出现CO <sub>2</sub>
1987.1.17	H <sub>2</sub> +CO	11	电话	1900km	出现CO <sub>2</sub>

1. Experiment dates
2. Experiment contents
3. Room temperature degrees C
4. Method of staying in contact with Dr. Yan Xin
5. Energy emission distance
6. The experiment result
7. Telephone
8. CO<sub>2</sub> appeared

Dr. Yan Xin transmitted energy usually from 7 km, but sometimes from 1900-2000 km.

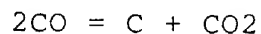
That long-distance emission can cause an effect on the molecular quality of the material has never been proved before this.

#### 5. Experiment result and Discussion

After the action of Qi, the infra-red spectrums of the compound gas inside the infra-red cells all show 3 new peaks. The different value of these is  $2362.5 \text{ cm}^{-1}$  and  $2340.5 \text{ cm}^{-1}$ . These are a characteristic of the  $\text{CO}_2$  key vibration. From this we can see that under the action of Qi, the compound gas systems all create  $\text{CO}_2$  every time.

In one case the  $\text{CO}_2$  that had already been created in one compound gas system, unfortunately destroyed 2 hours after the experiment completion. (See Illustration 4.)

This seems to show that a reversible disproportionation reaction is caused by the effect of Qi on compound gas"



Later on Dr. Yan Xin was asked if it was possible for him to increase the amount of  $\text{CO}_2$  created in the compound as and simultaneously make it stable under the influence of Qi. In the following long-distance experiment, after the infra-red

survey was completed, we discovered that the amount of CO<sub>2</sub> created had increased dramatically.

To check if the CO<sub>2</sub> created this time inside the infra-red cell existed stably, we conducted a test in which we tracked it for 4 days. the result showed that the CO<sub>2</sub> did not get destroyed during our testing period. This experiment is shown in Illustration 5.

in this experiment, Qi energy was transmitted from Guangzhou to Beijing. The result showed that CO<sub>2</sub> was created in the compound gas system. At the same time, the contrast specimen showed that the amount of CO<sub>2</sub> created in it was comparatively less. These experiments are shown in Illustration 6.

These experiments show that a high-level Qigong Master can. through the use of different Qigong techniques, achieve whatever goal is desired. These courses of action, especially the over-coming long-distance mechanics. are very valuable in research and inquiry.

The reaction process in which a stable CO<sub>2</sub> is created is generally found in the F-T compound, methanol compound, etc. compound gas systems. This type of disproportionation process usually requires catalysts and several hundred



degrees of high temperature conditions. The relationship between its thermodynamic equilibrium constant and temperature can be seen in Table 2.

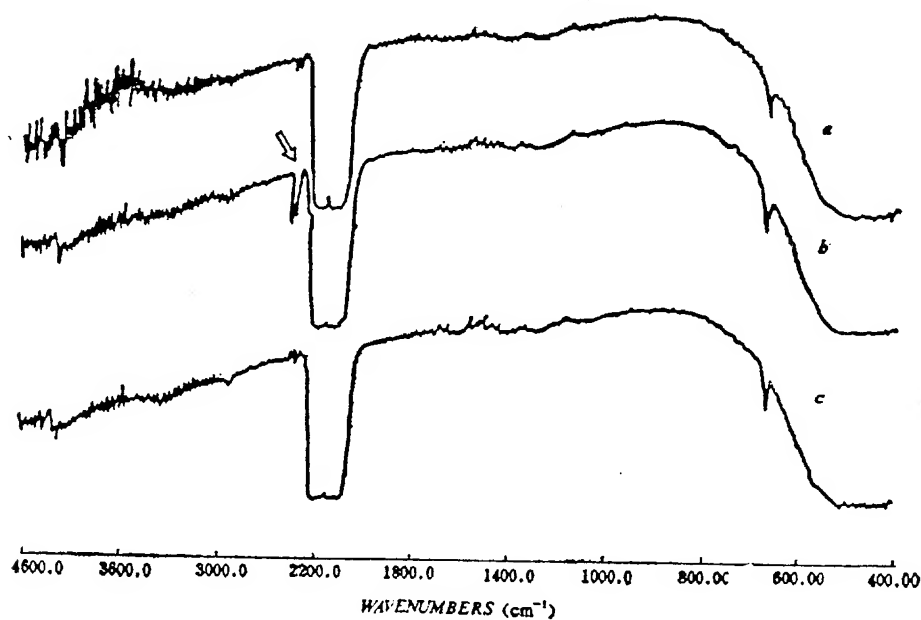
Table 2

The equilibrium constant of the disproportion reaction

$K = P_{CO_2} / P_{CO}^2, \text{atm}^{-1} (1.01325 \times 10^5 \text{Pa})^{-1}$			
400 K	500 K	600 K	700 K
$2.1 \times 10^{-11}$	$6.1 \times 10^{-8}$	$5.9 \times 10^{-5}$	4102

Illustration 4

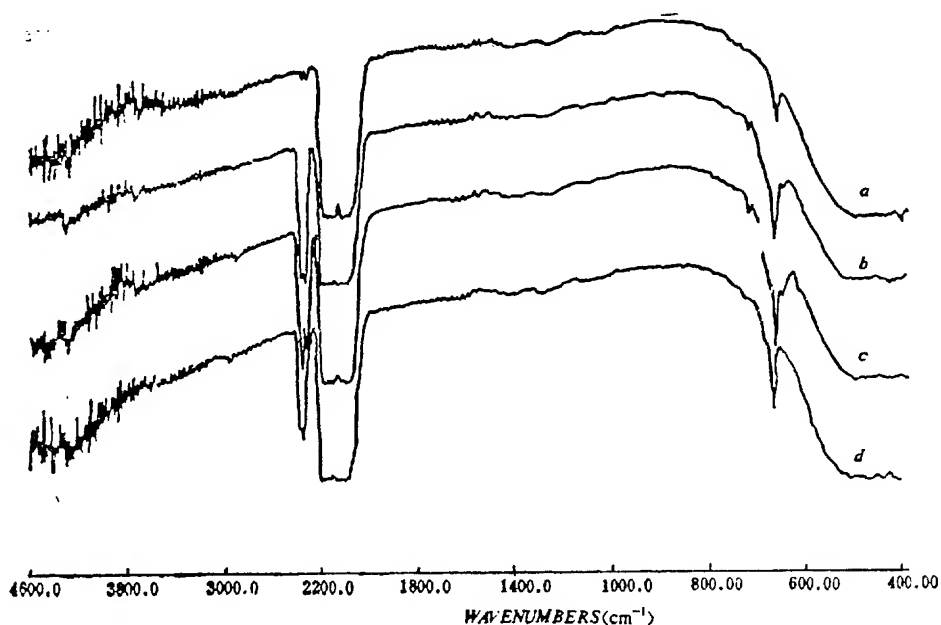
The equilibrium constant of the disproportionation reaction



- a. The compound gas spectrum before energy emission
- b. The compound gas spectrum 0.5 h after energy emission
- c. The compound gas spectrum 2 h after energy emission

Illustration 5

The infra-red spectrum of the  $\text{CO}_2$  created in the compound gas system. Light flux 7000 lumens



- a. 15 minutes before energy emission
- b. 0.5 hours after energy emission
- c. 1 day after energy emission
- d. 4 days after energy emission

If we look at things from the angle of thermodynamics, low temperature conditions benefit the disproportionation

reaction process. If these conditions are not used, the kinetic speed constant of the  $\text{CO}_2$  created is very small.

But under conditions where  $\text{Q}_i$  is used, the compound gas can create a comparatively large amount of  $\text{CO}_2$  in a short time.

Therefore, due to what process is  $\text{CO}_2$  manifested under the action of  $\text{Q}_i$ ? What are the mechanics of  $\text{Q}_i$  action? These questions are very valuable for inquiry and research.

It is important to see that earlier on, when it was pointed out that the compound gas was capable of manifesting the disproportionation process, it was taken as a mere conjecture. This is because the vestibule volume of a normal position infra-red cell which was used was very small (volume is around 0.16 ml and optical distance around 1-2mm). Therefore the carbon, which came out through the disproportionation reaction, was never tested before this. The work of this article was merely to precisely realize the remarkable fact that is possible for a compound gas system to create  $\text{CO}_2$  without the use of a catalyst under constant temperature conditions by using infra-red light as a medium.

The above mentioned work is only a beginning in the inquiry

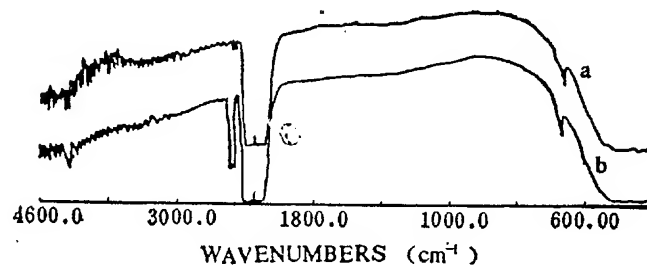
into the profound mystery of the effect of Qi on compound gas systems.

#### References

- (1) Anderson, R.B., The Fisher-Tropsch Synthesis  
Academic Press, Inc., 1984

#### Illustration 6

The CO<sub>2</sub> created by Qi action from 1900 km away



- (a) 10 minutes before energy emission (Light flux = 2000 lumens)  
(b) 45 minutes after energy emission

**The Substitution of n-Hexane by Bromine Induced by Qigong**

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- Li Shen Lin (Chemistry Department, Qinhua University)
- Chang Zengjia (Chemistry Department, Qinhua University)
- Zhen Zuying (Chinese Scientific Institute, High Energy Physics Department)

**Summary**

Given the important role of chemical reactions in biological processes, can Qi affect the organic body systems and treat sick people from a long distance? The clinical practice of Qi is commonly used to treat sick people even at a distance. But ours was the first experiment to attempt a preliminary scientific verification of this phenomenon.

The Qigong Master (Dr. Yan Xin) emitted Qi on a test-tube of a Bromine and n-Hexane compound solution from distances of tens of meters to 10 km. The solution was in room temperature and in darkness. Yet after Qi emission, the original deep-red color of this solution became colorless.

Infra-red analysis showed that a 3Br-C link vibration peak appeared showing that a substitution reaction had occurred in the

Bromine n-Hexane system. At present the mechanism of this long-distance action remains unclear.

### 1. Experiment Design and Method

A. Experiment equipment and chemical reagents. The analysis equipment used is a 5 DX "Boliye" alternate infra-red recorder produced by the Nicolet Company. The reagents used were analysis pure n-Hexane and liquid Bromine, both from the Beijing Chemical Reagent Factory.

B. Experiment design. The experiment was at effect of the physical stamina, mood etc. of the Qigong Master. Therefore it was critical to ensure the complete reliability of testing methods.

The substitution reduction in alkane systems is a well-known chemical process. A Benzine n-Hexane compound solution can undergo a free-base substitution reaction when strong light is applied to it.

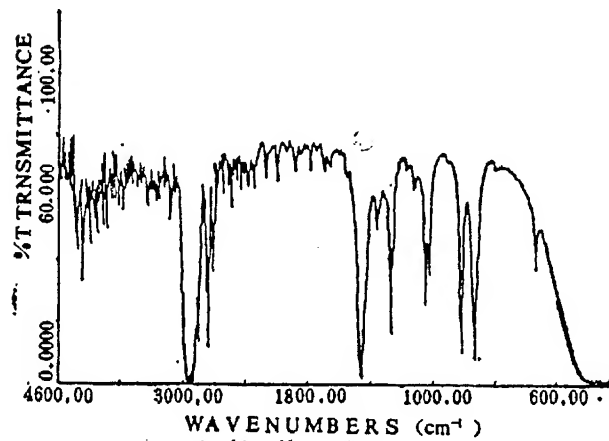
C. Testing the specimen The Benzine N-Hexane is a deep red color due to the existence of Benzine molecules. As soon as these molecules cease to exist, the color disappears.

A model Benzine N-Hexane mixture solution is shown in Plate 1. Using an infra-red device, any change is easily detected. The infra-red spectrum of a constant Benzine N-Hexane compound solution

is shown in Plate 2. (Translator's note: Plates 2 and 4 are actually illustrations; Plates 1, 3 and 5 are photographs.)

Plate 2:

Benzine n-Hexane mixture solution's infra-red spectrum. Light flux : 10,000 lumens



D. Contrast Experiment. We conducted two sets of contrast experiments. The mixture solutions were the same as for those specimens receiving Qi.

The specimens used for the first contrast experiments were in 4 test-tubes. We wrapped these in double-layer kraft paper envelopes and placed them inside a dark room. After two months, we discovered that neither the color nor the infra-red spectrum of the Benzine n-Hexane solution had changed.

The second contrast experiment was to see if a flashbulb can cause any reaction in the Benzine N-Hexane solution, as each specimen is photographed before the experiment. We illuminated 4 test-tube specimens 10 times with a flas bulb before sealing them inside double-layer kraft-paper envelopes placed inside a dark room. No change was detected after 3 days.

E. The Qigong Experiment Method. Because a substitution reaction can occur in the Benzine N-Hexane mixture solution under high light, all the preparation, composition, packaging and receiving energy was conducted at night.

Preparation work began an hour before the experiment. First a solution was compounded of 1 ml liquid Benzine and 40 ml n-Hexane. It was then divided into 4 test tubes stopped with rubber stoppers. These test tubes were enclosed in double-layer kraft paper envelopes. Two were used for the experiment and two as contrast specimens.

Five minutes before the experiment, the 4 specimens were photographed after unwrapping. They were then enclosed in the envelopes again. One set of 2 was placed inside a dark chamber. The door was locked and the specimens were ready for Qi emission.

The other set of 2 test-tubes was placed in a dark chamber around 20 meters from the first laboratory to act as a contrast specimen.



The energy emission was for 5-10 minutes every time. The test-tubes were then removed for examination of color changes. Simultaneously, the contrast specimens were unwrapped, and a color contrast conducted.

An infra-red analysis was also conducted on the specimens and a comparison made of the infra-red spectrums before and after the experiments.

The experiment was conducted four times. the results are given in Table 1.

Table 1

The experiment conditions of the Benzine n-Hexane mixture solutions

1. 实验日期	2. 实验内容	3. 室 温 °C	4. 联络方式	5. 发功距离 km	6. 实验效果
1987.2.27	溴+正己烷	16	电话	7	变色
1987.2.27	溴+正己烷	16	电话	10	变色
1987.3.4	溴+正己烷	16	电话	3	变色
1987.9.27	溴+正己烷	25		0.01	变色
7.			8.		9.

1. Experiment day
2. Experiment contents
3. Room temperature, degrees C
4. The method of staying contact
5. Energy emission distance
6. Experiment results
7. Benzine and n-Hexane
8. Telephone
9. Changed color

## 2. Experiments results and Discussion

These experiments show that the long-distance energy emission by Qigong Master Dr. Yan Xin can have a real effect on the Benzine n-Hexane mixture solution. We tested the above solution using an infra-red monitor. The results showed that the already expanded vibration peak of the 3Br-C link was stimulated at  $6.885 \text{ cm}^{-1}$ . The infra-red spectrum of the specimen inside the test-tube before and after energy emission can be seen in Illustration 4.

Accordingly, we proved that a substitution process was manifested. But because the Bromine amount in the solution is comparatively small, the H-Br created by the substitution process is also small. The increased H-Br vibration link position is roughly at  $2969 \text{ cm}^{-1}$ . This is also the position of the strong vibration peak of the methyl link in n-Hexane. Due to this, it was very difficult to examine the vibration peak of the H-Br link.

It is generally known that under the action of light, a free base substitution reaction can occur in a Benzine and n-Hexane mixture solution. In this reaction, the homolysis of Benzine molecules under light action produces a free base leading to a chain reaction. This important step is as follows:

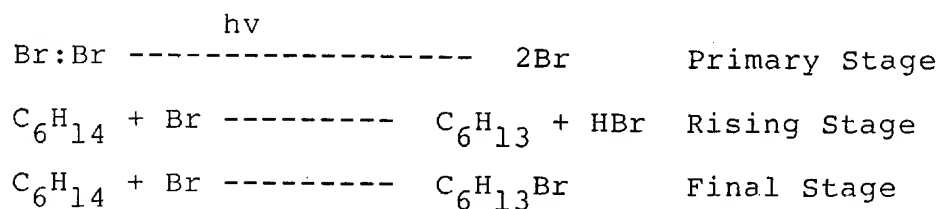
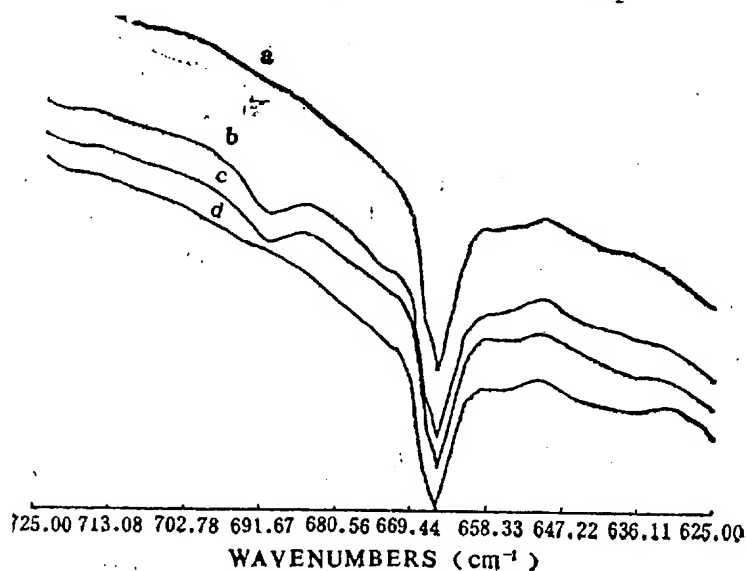


Illustration 4

The Infra-red Spectrum of the Bromine and n-Hexane mixture solution before and after the experiment



- (a) n-Hexane solution infra-red spectrum
- (b) Bromine + n-Hexane solution infra-red spectrum after experiment
- (c) Bromine + n-Hexane solution infra-red spectrum after experiment
- (d) Bromine + n-Hexane solution infra-red spectrum before experiment

The contrast experiment has already shown that under conditions of room temperature (13-16 degrees C) and no light, it is not possible for an independent substitution reaction to take place on the solution, especially not in such a short period of time (from energy

emission to examination 20-25 minutes).

But under the action of Qi, especially long-distance energy emission, this substitution reaction does take place.

Yet another strange phenomenon occurred. In order to show that Qi action can be precisely directed to a certain region, in one experiment Dr. Yan Xin emitted energy on two test-tubes of the solution. In one, the color completely changed in the 2 cm high test-tube. But in the other 2 cm high test-tube, he caused the color of the upper 2/3rds of the solution to fade, and the lower 1/3rd remained the same. This can be seen in Plate 5.

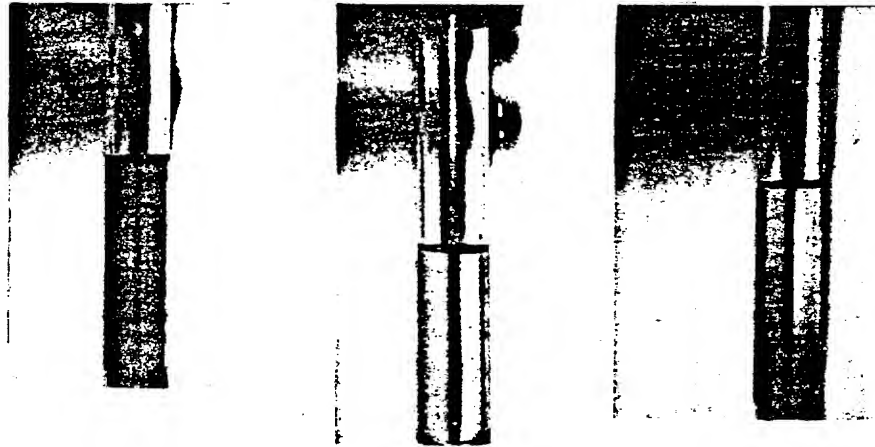
The photographic record of this experiment proves that Qi definitely has directionality and can be focused over any given area. This is already accepted in the clinical practice of Qi.

The above mentioned test-tube specimen which had only partially changed color, became completely colorless after 30 minutes had passed. Using the infra-red test, we saw that a similar substitution reaction had occurred in this solution.

Now we need further exploration as to whether the substitution reaction in the Benzine and n-Hexane mixture solution caused by Qi has other reaction avenues apart from that of the homolysis of the independent base pattern.

Clearly we have conducted only one type of test. The work is only a first step. But it does show that Qi can cause a substitution reaction in Benzine and n-Hexane mixture solutions, even at a long distance.

Plates 1, 3 and 5



- Plate 1: Photograph of the color of Benzine n-Hexane mixture solution.
- Plate 3: Photograph of the faded color of the Benzine n-Hexane mixture solution as affected by long-distance emission of Qi.
- Plate 5: Color photograph of the partial fading of the color of the Benzine n-Hexane solution under the long-distance action of Qi.

## An Initial Look at the Effect of Qi on Some Free Radical Reactions

- Guo Shuhao (Jinan University Chemistry Department)
- Zhan Zennqi (Hunanan Teacher's College Physics Department)
- Guo Xiaoming (Jinan University Physics Department)

### Introduction

Taking Qi's action on some chemical changes, we looked at the effect of Qion some chemical reactions. Thus we were able to come up with some meaningful ways of using Qi. In the past few years. we have done pioneering work on the action of Qi. part of which has already been published (1). In this paper, we basically want to introduce the effect of Qi on some free radical reactions.

### 1. Experiment Method

The reaction we chose to experiment on is one which has been observed for a long time, i,e, the reaction mechanism of the free radical reaction in the alkane bromine substitution reaction.

The alkanes used were n-hexane and cyclohexane (colorless) and the benzine was prepared into a benzine and carbon tetrachloride solution (reddish-orange color). Under well lit conditions, the reaction produces hexane bromide (colorless, comparatively complex product).



The Qi emission time was 5 minutes.

3. Then the 2 black paper muffs were removed and the 2 colorimetric tubes were placed in 2 test-tube stands. They were then exposed to light. The reaction began, and the color slowly changed in the colorimetric test tubes. We measured and recorded the time it took for the color to change from red to colorless.

4. To measure the color-change in a spectrophotometer, we took the 2 colorimetric test-tubes, i.e., one on which Qi had been emitted and the contrast specimen; and before they were exposed to light, their solutions were quickly poured into two colorimetric utensils measuring 2 cms. These were then placed in a spectrometer. We used the n-hexane solution to act as a reference solution and in  $\lambda = 600 \text{ nm}$ , we measure the Absorption (A).

## 2. Experiment Results

(1) The visual colorimetric method: In 1985, from December 6 to 8, 14 Qigong teachers emitted Qi from the city of Guangzhou (the site of the Guangdong Province of Qigong Scientific Research.) The experiments were conducted at Jinan University. The results showed that when 10 Qigong Masters emitted Qi,



the reaction proceeded at different levels of delay and the color changed slowly. There was only one instance when one of Qigong Masters energy emission was unclear. The results are in Tables 1 and 2.

2. The Spectrophotometric Method: We used a spectrophotometer in order to reduce the chances of human error that might occur in the visual colorimeter method. The 721 Spectrophotometer was employed to compare the reaction proceedings between the different colors of the 2 solutions in the Qi emission test-tube and the contrast. This was done by comparing the absorption levels.

From the middle of March 1986, we requested 4 Qigong Masters and a few Qigong enthusiasts to conduct a series of experiments. First we chose 4 sets of experiments (Tables 3, 4, 5 and 6). In these, n-hexane was used as the reference solution. We measured the absorbance as  $\lambda = 600 \text{ nm}$ .

Table 3 is different. In Table 4, the absorbance was measured every 5-10 minutes. In Tables 4 and 6 we only measured it twice. The first time was absorbance before the experiment; the second was absorbance after the solution had turned colorless.

### 3. Discussion

1. The experiments were conducted for over one year. The Qigong Masters and enthusiasts participating numbered nearly 20. Only one Master failed to get a clear effect.

Notable among these are Qigong Masters He Heng and Zeng Qiang who participated several times. All the results were remarkable.

2. From the different readings we got in our experimenyts, we can see that different Masters and enthusiasts can have different effects on the reactions. Some of them can come up with an accelerated action, and others with a slowing down effect.

3. That Qi can cure sickness and strengthen the human constitution is something people already accept. Moreover, biological phenomena is based on chemical reactions. In recent years, in-depth research by scientists both in China and abroad has revealed that biological phenoemna like old age and cancer etc. have a relationship with the action of free radicals.

Some of the research data has shown that the existance of free radicals inside the human body has a two-fold effect. On one hand, free radicals give the body resistance, but on theother. there is a possibility that free radicals cause

imbalances in the body's equilibrium and could cause early aging (2).

Therefore, our research on the effect of Qi on chemicals, especially some free radical reactions, can identify avenues for further research on the mechanisms of the effect of Qi on physiology or biochemistry.

#### References

1. Guo Shuhao et al: Guangdong Qigong Scientific Research Academic Exchange Conference Treatise Compilation.
2. Li Wenjie The Chemistry of Life 1986; Vol. 6, Chapter 5. Page 45.

Table 1

Summary of Experiment Conditions of 10 Qigong Masters

1. 发气时间(min)	2. 平均褪色时间(t)(min)		
5	3. 试验组( $t_1$ )	4. 对照组( $t_2$ )	5. 时间差( $t_1 - t_2$ )
	27	19.4	7.6

1. Energy emission period (minutes)
2. Average time in which color fades (t) (minutes)
3. Experiment group ( $t_1$ )
4. Contrast
5. Time difference ( $t_1 - t_2$ )

Table 2

A summary of the experiment conditions of 3 Qigong Masters

1. 发气时间(min)	2. 平均褪色时间(t)(min)		
5	3. 试验组( $t_1$ ) 14.3	4. 对照组( $t_2$ ) 20	5. 时间差( $t_1 - t_2$ ) -5.7

1. Energy emission period (minutes)
2. Average time in which color fades (t) minutes
3. Experiment group ( $t_1$ )
4. Contrast
5. Time difference ( $t_1 - t_2$ )

(continued next page)

Table 3

The effect of Qi on the reaction (accelerate)

1. 试验日期	1986.7.20		2. 气功师	3. 曾 强	
4. 测定时间	5. 吸光度(A)		8. 测定时间	9. 吸光度(A)	
	6. 对照液	7. 试验液		10. 对照液	11. 试验液
9:52	0.55	0.58	11:03	0.14	0.08
10:00	0.70	0.70	11:08	0.13	0.06
10:05	0.67	0.67	11:13	0.12	0.06
10:10	0.46	0.46	11:18	0.106	0.05
10:17	0.43	0.42	11:23	0.105	0.05
10:23	0.40	0.36	11:30	0.09	0.05
10:28	0.35	0.32	11:35	0.09	0.045
10:33	0.28	0.26	11:40	0.085	0.04
10:38	0.25	0.22	11:50	0.08	0.037
10:43	0.21	0.17	12:00	0.075	0.035
10:48	0.20	0.135	12:05	0.07	0.035
10:53	0.17	0.09	12:15	0.065	0.035
11:58	0.155	0.07	12:20	0.065	0.035

12.(停)

1. Experiment date
2. Qigong master
3. Zen Qiang
4. Measurement time
5. Absorbance (A)
6. Contrast solution
7. Experiment solution
8. Measurement time
9. Absorbance A
10. Contrast solution
11. Experiment solution
12. Stop

Table 4

The effect of Qi on the reaction (accelerate)

1. 试验日期	1986.8.17		2. 气功师	3. 柯 衡
4. 测定时间	5. 对 照 液		8. 试 验 液	
	6. 透光率(T)	7. 吸光度(A)	9. 透光率(T)	10. 吸光度(A)
12:10	30%	0.523	31%	0.509
15:35	62%	0.208	93%	0.032

1. Experiment date
2. Qigong Master
3. HeHeng
4. Measurement time
5. Contrast solution
6. Transparency (T)
7. Absorbance (A)
8. Experiment solution
9. Transparency (T)
10. Absorbance (A)

Note 1. In accordance with Lambert-Beers Law: The relationship formula between Absorbancy and Transparency is:

$$A = 1g \frac{I_a}{I} = 1g \frac{1}{T}.$$

2. The processing method for the reaction solutions in Tables 4 & 6 is not the same as the general operations. They are not exposed to bright light, but are wrapped in black paper muffs and kept in soft lighting.

Table 5

The effect of Qi on the reaction (delay)

1. 试验日期	1987.3.1		2. 气功师	3. 焦趣南	
4. 测定时间	5. 吸光度(A)		8. 测定时间	9. 吸光度(A)	
	6. 对照液	7. 试验液		10. 对照液	11. 试验液
2:30	0.520	0.530	4:20	0.318	0.268
2:35	0.548	0.550	4:25	0.291	0.230
2:40	0.545	0.548	4:30	0.255	0.198
2:45	0.542	0.549	4:40	0.170	0.164
2:50	0.541	0.543	4:50	0.122	0.137
3:00	0.538	0.540	5:00	0.081	0.107
3:10	0.531	0.532	5:12	0.063	0.093
3:20	0.522	0.530	5:20	0.054	0.082
3:30	0.530	0.549	5:25	0.050	0.079
3:40	0.550	0.570	5:30	0.048	0.075
3:50	0.560	0.580	5:40	0.040	0.066
4:00	0.500	0.420	(停)		
4:10	0.312	0.328			

1. Experimental date
2. Qigong Master
3. Xiao Gainan
4. Experiment time
5. Absorbance
6. Contrast liquid
7. Experiment solution
8. Measurement time
9. Absorbance
10. Contrast solution
11. Experiment solution

(continued on next page)

Table 6

The effect of Qi on the reaction (delaying)

1. 试验日期	1986.8.21		2. 发气者 郭××	
3. 测定时间	4. 对 照 液		7. 试 验 液	
	5. 透光率(T)	6. 吸光度(A)	8. 透光率(T)	9. 吸光度(A)
10:40	31%	0.509	81.5%	0.502
16:15	90%	0.046	79%	0.102

1. Experiment date
2. Qigong Master Guo
3. Measurement time
4. Contrast solution
5. Transparency
6. Absorbance
7. Experiment solution
8. Transparency
9. Absorbancy



ANALYSIS ON EEG POWER SPECTRUM DURING QIGONG STATES AND  
THE EFFECT OF THE EMITTED QI RELEASED BY QIGONG MASTER

[Niu, Xin; Liu, Guolong; and Yu, Zhiming, Beijing Institute of Traditional Chinese Medicine]

Chinese qigong, with a history of several thousand years behind it, has a very rich substance and involves medical science, physical education, arts, martial art and religion. As reported in pertinent documents, it had been in vogue as the method for life preservation even before the Spring and Autumn Period (770-476 B.C.) and the Warring States (475-221 B.C.)<sup>[1]</sup>. Qigong-therapy is a general medical term for qigong and should be carried out in two aspects: The patient exercises qigong himself to invigorate the functions of his internal organs for the sake of eliminating illness and prolonging life, and the qigong master releases his emitted qi into the patient to achieve the objective of medical treatment, which in the ancient time was called "pushing qi" and categorized as the qigongtherapy with emitted qi.

Both traditional Chinese medicine and the theory of qigong believe that human body is an integrated organic entity of "physique" and "mind," and advocate that "all qi is from the brain," showing that man's mental faculties have an enormous impact on the body. Because the central nerve system plays a role in regulating human body, heart and breath by qigong, and a person's mind and conscious activity definitely affect the function of his pallium, qigong researchers have all along attached great importance to the techniques for EEG analysis. In the early 60's, Xiao Zun, Qin Chen and others<sup>[2,3]</sup> ran an EEG study on qigong practitioners using EEG as the index; in late-70's, Zhao Guangxiong and fellow researchers<sup>[4]</sup> conducted contrast observation of their neuro-electrophysiology with EEG integration. However, due to the complicated causes of formation and significant randomness of EEG, and the interference of noises at the time of measuring, all the means employed in past researches, such as visual method and EEG integration, have failed to pinpoint the law of electrical activity of the brain during qigong states.

Along with the development and popularization of computer techniques, there have been some effective ways to analyze EEG signals and obtain useful information through computers. In recent years, researchers in China have successfully applied analysis on EEG power spectrum to the study on qigong, yoga and transcendent meditation (TM)<sup>[5-14]</sup>, but most of the past work was limited to the EEG study of the internal qi of the body in the qigong state, and seldom touched the EEG changes in both the qigong master and the recipient at the time when the former was releasing emitted qi into the latter. Therefore, to explore how the functions of the brain are activated in the central nerve system during qigong states by the effect of emitted qi released by qigong master to find out the law of the activity is definitely of vital importance and significance for expounding the organic theory of qigong and unveiling the mystery of human brain. In this experiment, with the information processing system of advanced computers, we conducted a power spectrum analysis on the EEG changes in normal testees when under the effect of the qigong master's emitted qi and of subsonic sound, on their brain waves when under the influence of analog emitted qi, and on normal people's EEG recorded for a long period when they are in a static state.

## I. Method

Before the experiment, we first tested more than 20 participating qigong masters to determine the quality of subsonic sound in their emitted qi, and used it as the norm to select six having a subsonic sound level above 70dB for the test of the effect of emitted qi. The testees, all 18-30 years old, in good health and having no history of malfunctioning brain, were divided into four teams: 45 for the test of the effect of emitted qi, 20 for the test of the effect of subsonic sound, 28 for the test of analog emitted qi, and 27 for the test of normal people in a static state.

RM-6000 multi-wire biological recorder and RAIG-5304 magnetic recorder made by Japan's Nihon Konden Co. were used for recording, and electrodes were hooked up by unipolar leading-in in accordance with the internationally adopted standard 10-20 method<sup>[15]</sup>. During the experiment, we readied the testees for the test by entering them into full concentration with biofeedback produced by GSR-2, a product of Canada's Thought Tech. The "Shenyun" subsonic sound generator made by Shenyun Electronics Co., Ltd of Shenzhen City could generate 10Hz subsonic waves in three different intensities. We adopted the double-blind method and analog emission of qi by a non-qigong practitioner to lessen psychological disturbance to the testees. At the beginning of the experiment, the testees stayed in a static state for 15-20 minutes and took a five-minute recording of their brain waves for self-contrast, and then began the EEG recording after being under the effect of the emitted qi released by qigong master. The identical recording procedure was applied to the other three teams.

The magnetic recorder fed the recorded time-domain brain waves into 7T17(S) signal analyzer made by Japan's Sanei Co., and the frequency domain power spectrum was obtained after they went through fast Fourier transform (FFT). Of the acquisition of analog EEG signal samples, the time was 10ms, the number of points were 256 on each channel, the analysis time was  $256 \times 10\text{ms} = 2.56\text{s}$ , and the number of spectrum-line points was 100. A 0-40Hz power spectrum was reached after materialization of data and elimination of noises and interfering signals. The results of the analysis is composed of three parts: (1) the array of compressed power spectrum, (2) the diagram of average power spectrum, and (3) the diagram of T-test, all showing the EEG power spectrum in the four areas of the brain. The 10 front rows in the array are the power spectrum of self-contrast and 10 rear rows the power spectrum after the brain being affected by all different factors. The solid and dotted lines in the average power spectrum denote the changes before and after the effect of the emitted qi released by qigong master, respectively. In both the array and the average power spectrum, the vertical axis represents the relative energy and the horizontal axis the frequency range. The diagram of T-test corresponds to the other two diagrams, and the interfacial value of its solid line is  $T = 0.01$  and of its dotted line is  $T = 0.05$ . All the results of these three parts are printed by 7T17(S) signal processor.

## II. Results

1. Compared with the team for the test of analog emitted qi, the team for the test of the emitted qi released by qigong master shows an obviously different change in its power spectrum ( $p < 0.001$ ), and so does it in the

comparison with the team for normal contrast ( $p < 0.001$ ). Of this team's examples of self-contrast, 20 show a distinct difference ( $p < 0.05$ ), and 12 show a very distinct difference ( $p < 0.01$ ). (See chart 1 and diagram 1) The change in the EEG power spectrum of the team for normal contrast and of the team for the test of analog emitted qi have no statistical significance.

2. The change in the EEG power spectrum under the effect of the emitted qi released by qigong master is featured by energy expanding in the frontal area and making a reverse turn in the frontal and occipital areas, and the whole pilot power spectrum synchronizing with alpha rhythm. Diagram 2 is the power spectrum in mean square root under the effect of the emitted qi released by qigong master. Before the effect, EEG in the occipital area takes alpha rhythm as the main rhythm and has a character peak, and the peak of alpha rhythm in both the temporal area and the frontal area is low and flat. Two minutes after the effect, EEG in the occipital area begins to spread and seemingly moves to other areas. Three minutes after the effect, the peak of alpha rhythm in both the frontal area and the top area is noticeably rising and energy is concentrating, and the peak of alpha rhythm in the occipital area is declining slightly. The array in the compressed power spectrum, the diagram of average power spectrum and the diagram of T-test in Diagram 3 show a reverse turn of energy in the frontal and occipital areas even more directly. In this diagram, we can clearly see that energy is larger in the occipital and top areas and very small in the temporal and frontal areas before the effect of the emitted qi released by qigong master, while after the effect, as indicated in the power spectrum, it expands most distinctly in the frontal area, reduces in the occipital and top areas, and changes very slightly in the temporal area. The energy expansion in the frontal area and reduction in the occipital area in the power spectrum in Diagram of T-value are of statistical significance ( $p < 0.05$ ).

3. After being affected by the effect of the emitted qi released by qigong master, the dominating peak frequency in the EEG average power spectrum changes (see chart 2). This chart lists 11 examples showing a change in the value of the peak frequency in the testees' EEG average power spectrums after they have received the emitted qi from qigong master Yu XX. Except three examples which show no change, the peak frequency in the average power spectrum of all other eight examples moves 1-2.5Hz to the left after the effect. The subsonic sound frequency of the qigong master's emitted qi is 8Hz.

4. Compared with the team for normal contrast, the team for the test of the effect of subsonic sound also shows a quite significant change in its EEG power spectrum ( $p < 0.01$ ). After the effect, 13 of the 20 examples for self-contrast have a change of  $p < 0.05$  and 3 have a change of  $p < 0.01$ . Under the effect of a 10Hz, 90dB weak subsonic sound from the subsonic sound generator, the peak value energy expands in the alpha frequency range of 9-10Hz, whether in the occipital area or in the frontal area. The changes of all indexes in the power spectrum seem similar to the results of the test for the effect of the emitted qi released by qigong master. (The statistic  $\chi^2$  test  $p < 0.05$ ) (see chart 1, diagram 4).

### III. Discussion

1. There are no available data on the study of EEG changes under the effect of the emitted qi released by qigong master. Japanese scholar Fujiki Takeo<sup>[14]</sup> once reported that during the delivery of "remote attack" by a martial art master in a match, his opponent showed an obvious increase of EEG activity in both alpha rhythm and beta rhythm in his right lobe and occipital area. As indicated in the results of our experiment, after being affected by the effect of the emitted qi released by qigong master, the testee's energy is concentrating and expanding in the frontal and temporal areas, especially the latter, and making a reserve turn in both, which is different from what was reported by Mr. Fujiki. The reasons: (1) In his case, it is the "qi waves" delivered by the martial art master for attack, while in ours, it is the emitted qi released by the qigong master for therapy. (2) Since the two masters have different degrees of power, the "qi" released by them are of course different in quality. (3) In his case, the recipient is also a martial art master, while in ours, he is a normal, ordinary person. (4) We must also take the testee's state in the two cases into consideration. The Japanese team used the EEG remote recorder, and the martial art master being tested was still practicing and had a full scale of body movement during the recording, while our testee was motionless with his eyes closed, being in a relatively static state. Thus, these two tests cannot produce totally identical results; however, they have one thing in common, i.e., the "remote attack" or the spread qi causes an expansion, not a reduction, of energy in the testee's power spectrum. Whether or not we can use this instance to prove that human energy is transferred from one individual to another requires further study.

2. In his first recording of brain waves at Je Na in 1924<sup>[16]</sup>, Mr. H. Berger described that normal EEG had both alpha and beta rhythms, and that alpha rhythm had an 8-13Hz frequency which was most evident in the top and occipital areas and went into synchronization when the person was receiving a warning irritation. Now, we believe that the starting point of alpha rhythm is located in the reticular thalamic structure<sup>[18]</sup>. As the frontal lobe emerged only during the late period of the mankind's evolution, and is related to man's advanced function--conscious activity<sup>[20]</sup>, Mr. Eccles regarded the frontal area to be the place where the neural process changes to the conscious process.<sup>[20]</sup> The energy's reverse turn in the frontal and occipital areas and expansion in the alpha power spectrum of the frontal area during qigong states<sup>[5, 7]</sup> explain that at this moment, the thalamus and the pallium are functionally linked up with each other<sup>[5]</sup>; therefore, the fact that the testee being under the effect of emitted qi released by qigong master shows a change in the EEG power spectrum similar to the one when his internal qi is in a static state must have a special significance. These phenomena seem to suggest that qigong master's special state may affect the testee's brain function and lead him into a new power state similar to the qigong state. The catalyst that effects the connection and causes EEG changes in the testee is exactly the mysterious emitted qi released by qigong master; however, we do not rule out the possibility that the psychological factors between the qigong master and the testee may also result in these phenomena. Since emitted qi can make chemical changes in nonliving substances, nucleic acid and even as deep as at the cell level<sup>[21,22]</sup>, and arouses EEG changes in human body as seen in this experiment, it certainly confirms the existence of its function. Whether these phenomena are caused by psychological factors or by the special effect produced by emitted qi through a special receptor remains a mystery to be solved.

3. By testing, we know that the emitted qi released by qigong master has the quality of subsonic sound. If the detected subsonic sound is more than a phenomenon associated with the release of emitted qi, it is possible that its waves are carrying signals sent out by the qigong master. Human body being in a world full of vibrations not only generates but also receives them; thus, while the testee is feeling the vibration of the subsonic sound released by qigong master, he is also taking in other signals than the emitted qi. In this experiment, the testee's EEG frequency starts to change after he receives emitted qi from the qigong master, and toward the subsonic sound frequency in the emitted qi. Based on the available knowledge of EEG, we know that the change of everybody's adjusted alpha rhythm is not big, generally smaller than 1-1.5Hz<sup>[23]</sup>, but as the results of our experiment exceed this range, the subsonic sound frequency in the qigong master's emitted qi, therefore, is seemingly the signal causing the change in the testee's EEG frequency. In terms of intensity, the subsonic sound in qigong master's emitted qi being a weak subsonic sound cannot directly cause the brain to order a vibration; hence, the EEG change under the effect of the emitted qi should be a regrouped effect reorganized and processed by the pallium instead of a simple associated effect of outside irritation.

4. We choose subsonic sound for the experiment of contrast because we want to decide whether it can cause coherent oscillation in human brain as electromagnetic field does. As of today, the question of how alpha rhythm starts in human brain has not yet been fully answered. In 1941, Adrian<sup>[24]</sup> proved the close relationship between the rhythmic activity of the thalamic neuron and that of the cortical neuron. In 1950, Zhang Xiangtong explicitly pointed out that a reverberating circuit of oscillation is formed between the thalamus and its relevant pallium<sup>[25]</sup>. Since it is known that this feedback circuit is related to the generating of rhythmic activity in the pallium, human brain's alpha rhythm matches the subsonic sound spectrum, the vibration of subsonic sound waves has a frequency smaller than 20Hz and is not audible to humans, and most viscera's resonant frequencies are in the subsonic sound range<sup>[26]</sup>, would human brain be able to receive other irritating signals than those to the five senses? Since it is known that human brain can produce coherent oscillation with external electromagnetic field<sup>[27]</sup>, and the emitted qi released by qigong master can change the structure of artificial fat layer, would subsonic sound be also able to cause resonance and coherent oscillation in human brain, or say, in the thalamus's neuronal circuit? Neuronal circuit has its own fixed oscillation frequency and electrical characteristics. Since low-frequency electromagnetic oscillation can induce responses in the brain<sup>[24]</sup>, can't the vibration of subsonic sound or the vibrating elements in the emitted qi released by qigong master do the same? The emitted qi released by qigong master or the vibration of subsonic sound waves first changes the electrical characteristics of the neuronal membrane and then the number of transmission of nerve impulses in the neuronal circuit, and at last the frequency of the neural activity in the reverberating circuit between the thalamus and the pallium. Thus, the latent possibility that subsonic sound waves can change the frequency of human brain's oscillation does exist. As also attested by the results of our experiment, weak subsonic sound from the subsonic sound generator can cause an EEG change similar to that done by the emitted qi released by qigong master. Mei Lu has brought forward the theory of frontalization<sup>[29]</sup> believing that coherent oscillation due to the influence of outside environment is most likely to appear in the

frontal area. Hence, we guess that the oscillation of the subsonic sound in the emitted qi released by qigong master causes certain neuronal circuits between the thalamus and the pallium to be in coherent oscillation through a certain type of middle link. It seems that only this phenomenon is a possible neural mechanism causing a change in the testee's EEG rhythm when he is under the effect of the emitted qi released by qigong master.

#### Brief Summary

(1) Under the effect of the emitted qi released by qigong master, a normal testee's EEG power spectrum expands, more evidently in the frontal area. The change is similar to the EEG change when his internal qi is in a static state. (2) The characteristic of the subsonic sound in the emitted qi released by qigong master is related to the change in the testee's EEG frequency. (3) The subsonic sound waves produced by subsonic sound generator can cause similar results as the emitted qi released by qigong master does. Thus, by inference, qigongtherapy with emitted qi has its material basis. Qigong master can affect the patient's central nerve system through the emission of qi to achieve the objective of curing his disease.

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TREND OF THE CHANGES IN  
THE SELF-GENERATING EEG POWER SPECTRUM OF  
ALL TESTED TEAMS

CHART 1

EEG RATE IN DE % TEAM	EXPANSION OF POWER IN FRONTAL AREA	EXPANSION OF POWER IN OCCIPITAL AREA	TRANSFER BETWEEN FRONTAL & OCCIPITAL AREAS	WHOLE PILOT POWER SPECTRUM	WHOLE PILOT ALPHA RHYTHM COHERENT OSCILLATION	CHANGE IN FREQUENCY OF CHARACTER PEAK (Hz)	TEST OF DISTINCTNESS	
							$p < 0.05$	$p < 0.01$
Normal Contrast $n = 27$	(11)47.8	(10)43.4	(3)13.0	(4)17.4	(9)33.1	(9—11.5) 8.5—11.5	(2)8.7	
Effect of Emitted Qi $n = 45$	(41)91.1	(21)57.7	(19)42.2	(23)51.1	(31)68.8	(9—11.5) 8.5—11.5	(20)44.4	(12)26.6
Analogic Emitted Qi $n = 28$	(13)46.4	(1)39.2	(1)3.6	(5)17.9	(11)39.3	(8.5—11.5) 8.5—11.5	(3)10.7	
Effect of Ultrasonic Sound $n = 20$	(17)85	(11)55	(7)35	(9)49	(14)70	(9—11) (9—11.5)	(13)65	(3)15

NOTE: Number in parentheses denotes the number of examples. In the column of Change in Frequency of Character Peak number in parentheses denotes the range of change before the effect; number outside of parentheses the range during the effect

CHART 2

CHARACTER PEAK FREQUENCY IN TESTEE'S AVERAGE POWER SPECTRUM  
UNDER THE EFFECT OF THE EMITTED QI RELEASED BY QIGONG MASTER

TESTEE	LI	ZHU	LIANG	LI	FENG	WANG	YUAN	CHENG	LI	LI	WU
TESTEE	X	X	X	X	X	X	X	X	X	X	X
BEFORE THE EFFECT (Hz)	10	9	10	9.5	10.5	10	11.5	9	9	11	9
AFTER THE EFFECT	9	8	10	9.5	9.5	9.5	9	8	8.5	9.5	9

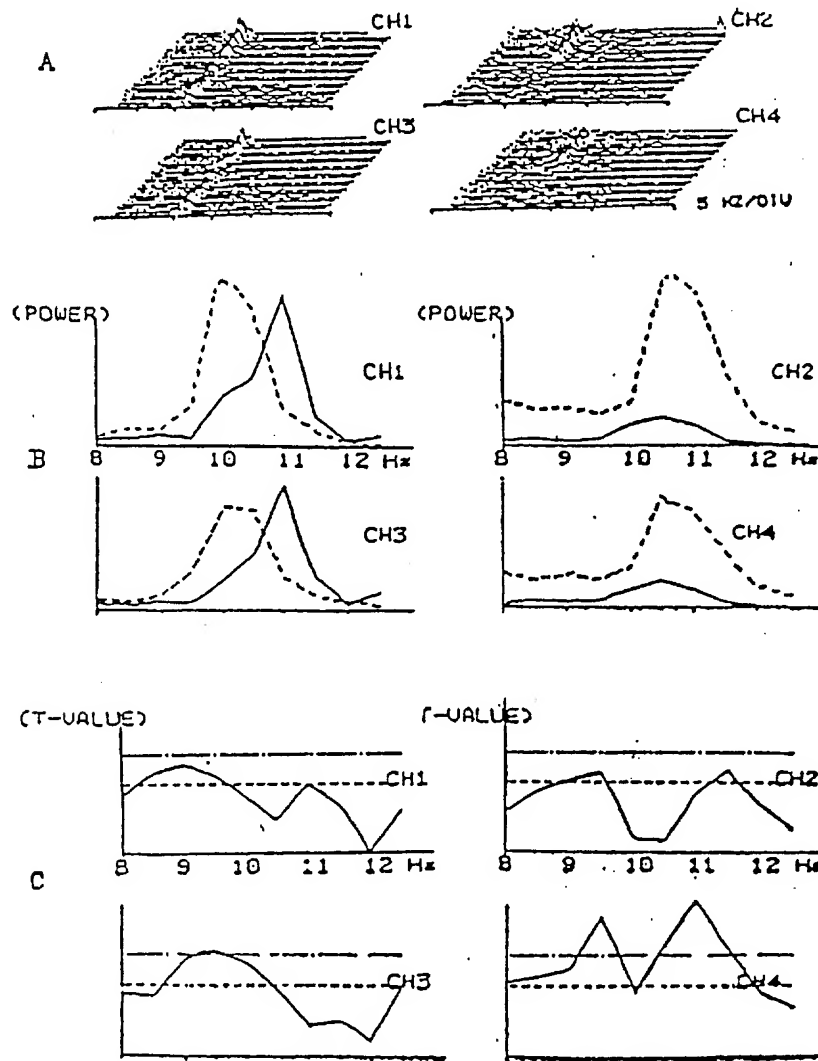


Diagram 1

Testee Jia XX's Array of Compressed EEG Power Spectrum, Diagram of Average Power Spectrum, and Diagram of T-Test Under the Effect of the Emitted Qi Released by Qigong Master Wu XX

CH<sub>1</sub> is O<sub>1</sub>, CH<sub>2</sub> is F<sub>P1</sub>, CH<sub>3</sub> is O<sub>2</sub>, CH<sub>4</sub> is F<sub>P2</sub>

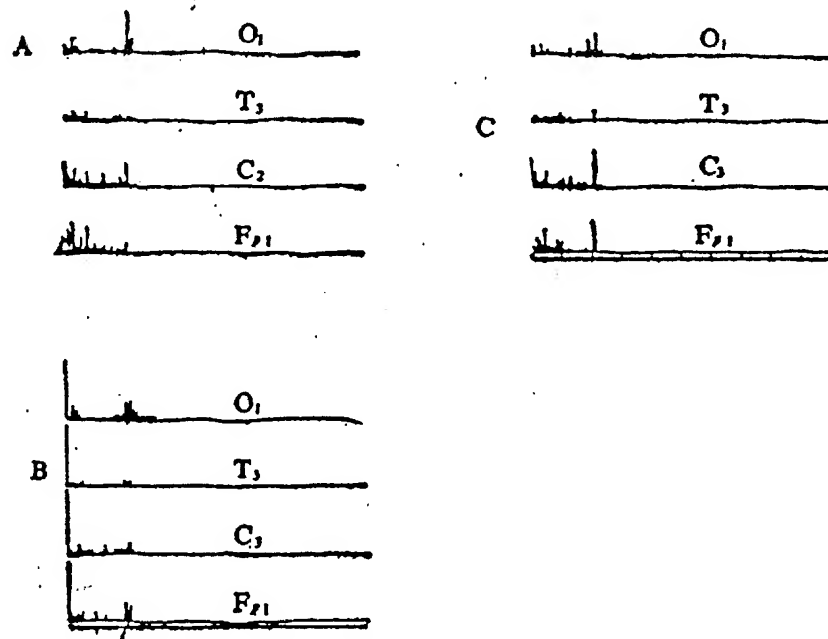


Diagram 2

Testee Peng XX's EEG Power Spectrum in Mean Square Roots  
After Being Affected by the Emitted Qi Released by Qigong Master

A -- Self-contrast before the effect.

B -- Two minutes after the effect.

C -- Three minutes after the effect.

(The emitted qi-releasing qigong master: Wu XX)

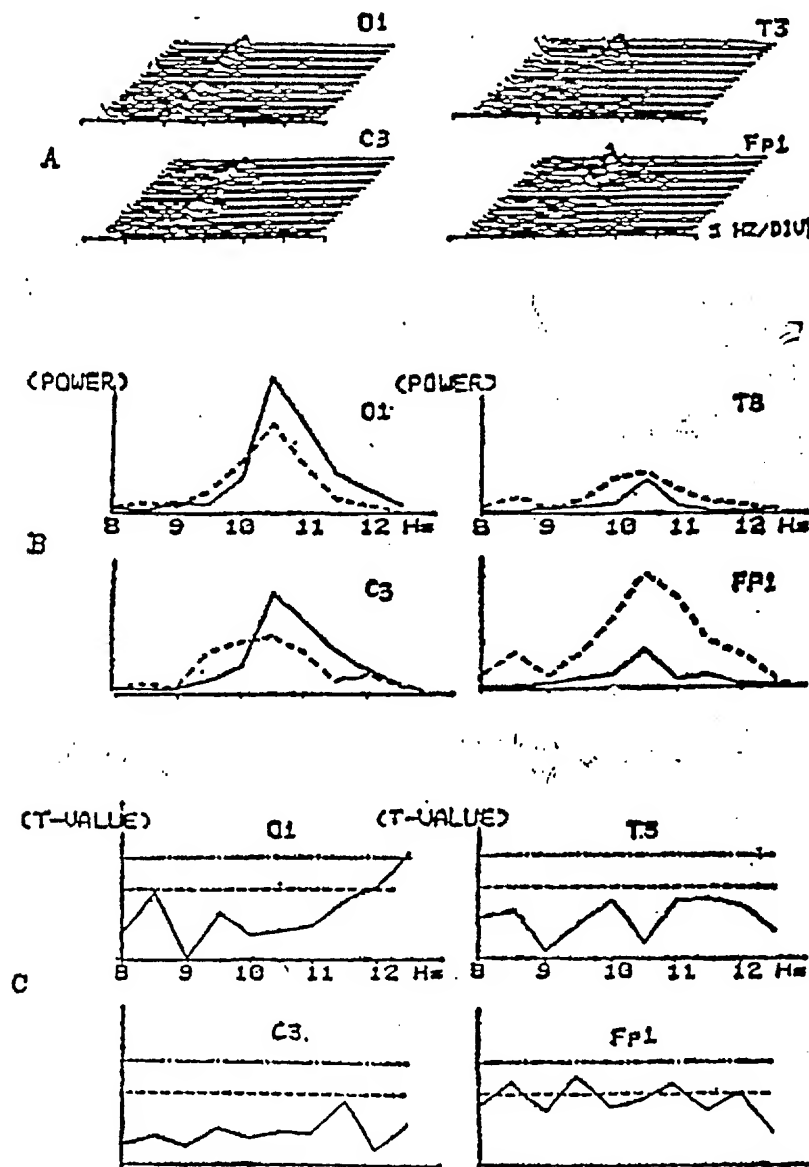


Diagram-3

Testee Feng XX's Array of Compressed EEG Power Spectrum, Diagram of Average Power Spectrum, and Diagram of T-Test Under the Effect of the Emitted Qi Released by Qigong Master Lu XX

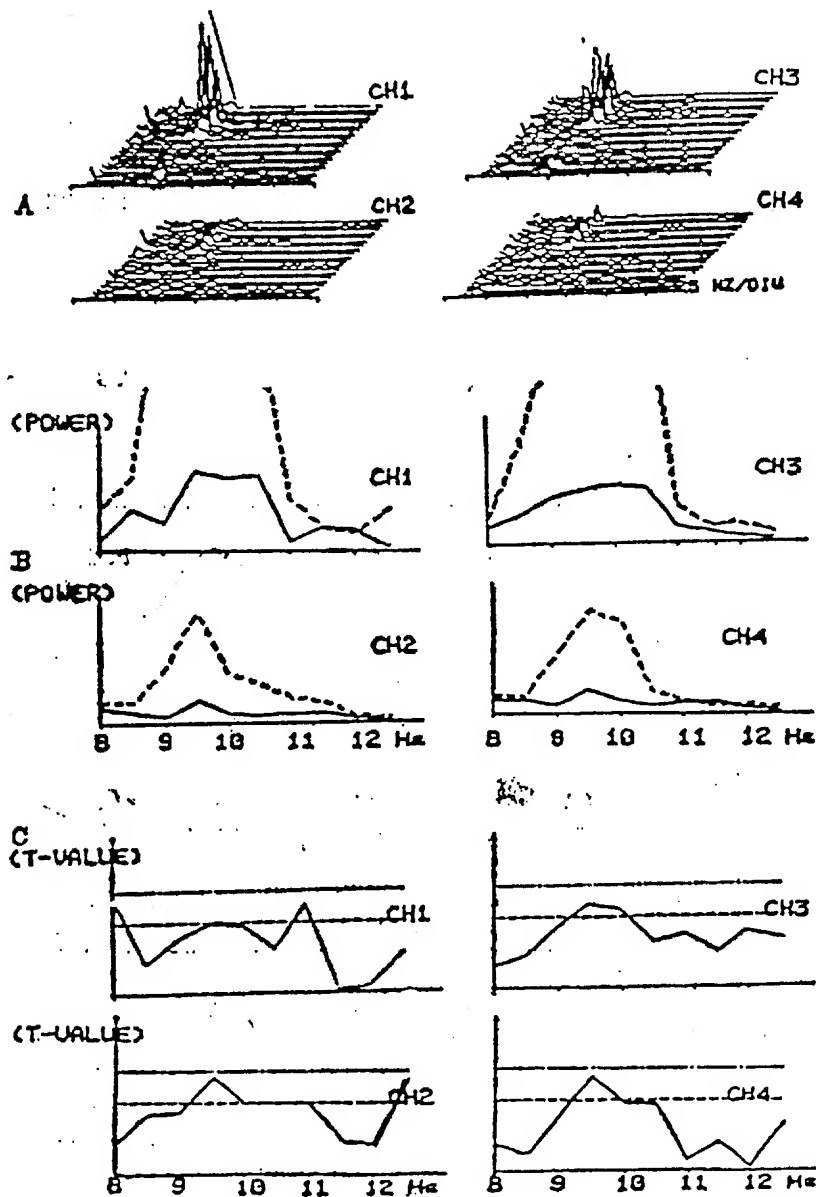


Diagram 4

The Array of the EEG Compressed Power Spectrum, the Diagram of the Average Power Spectrum, and the Diagram of T-Test Under the Effect of Subsonic Sound of 10Hz, 90dB

THE INFLUENCE OF EMITTED QI ON  
THE AUDITORY BRAINSTEM EVOKED RESPONSES AND  
AUDITORY MIDDLE LATENCY EVOKED RESPONSES IN THE CAT

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In China, using the emitted qi released by qigong master for health care and medical treatment has a long history. Many scientist at home and abroad are focusing their attention to this practice because it produces certain "enigmatic" effects. In the article of "Anthroposomatology Is a Large Department in the System of Modern Sciences," Prof. Qiang Xuesen explicitly points out that qigong is an important substance of anthroposomatology<sup>[1]</sup>. To the study of qigong mechanism with modern scientific techniques, his words are of guiding significance which we should not ignore. There has been a great deal of reporting in China and foreign countries on the biological effect of qi when it is in the intrinsic power state, particularly the effect on the central nerve system into which this laboratory has probed<sup>[2-15]</sup>, but the study on emitted qi remains in the starting stage as of today. Questions concerning emitted qi, such as whether it does exist and have materiality, what it is, how it is generated, whether it can be taken by human body to produce biological effect, all need to be answered. In recent years, many scientists in China have done considerable scientific study on emitted qi's physical effects and vigorously proven its materiality. The fact that it can change the birefringence of liquid crystal<sup>[14]</sup>, the structures of water, normal saline and glucose solution<sup>[15]</sup>, and the structure of fat layer<sup>[16]</sup> has confirmed its objective effect at the molecule level, and it functioning at the cell level has attested its biological effect<sup>[17, 18, 19]</sup>. By applying the analytic method to the array of EEG spontaneous potential power spectrum and the evoked potential of cortex, this laboratory has observed the effect of emitted qi on the central nerve system<sup>[10, 11, 13]</sup> and provided the basis for further experimental study on this issue. All past researches on the biological effect of emitted qi using human body as the object of experiment have failed to eliminate the influence of psychological factors because the testee's psychological activity is closely related to his spontaneous EEG potential and evoked potential no matter which one is taken for analysis. We all know that the effect of qigong itself cannot be free of psychological effect, but we cannot interpret it solely as a psychological effect, either. In a previous experiment conducted by this laboratory to eliminate the effect caused by psychological factors, we observed a rabbit with electrodes placed on it, and found that emitted qi indeed affected the spontaneous EEG potential in it when it was not anesthetized. In this experiment, we took anesthetized cat as the object to monitor how emitted qi influenced its auditory brainstem evoked responses (ABER) and auditory middle latency evoked responses (MLR), and confirmed that it did have an objective effect on the cat's central nerve system functioning mainly above the midbrain level in two forms, namely, the facilitating effect and the inhibiting effect. The findings are of vital significance for explaining how emitted qi regulates organic functions and treats diseases.

## I. Method

The cat, weighing 2.5-3.5kg, was anesthetized with chloralose at the ratio of 80mg to each kg of its weight and fixed on a stereolocator in an electrical shielding room by hollow ear bars through which sound was led for stimulation. It was kept warm in a 38°C thermostatic water mattress, and its ABER and MLR were evoked by 100 ms-wide short sound waves. The recorder was Neuropack-II MEB-5100, a potential evoking system which automatically processes data and feeds sound of a 70-90dB intensity into the animal's both ears. During the recording of ABER, the band-pass frequency was 100-3kHz, the real scan period 10 ms, the number of superimposition 256 times, and the superimposed frequency 10Hz; during the recording of MLR, the band-pass frequency was 5-1kHz, the real scan period 50 ms, the number of superimposition 256 times, and the frequency of superimposition 5Hz.

The recording to determine each evoked response was repeated 2-4 times until the curves became completely overlapped. In this experiment, the curves in all recordings had a good resettability, especially those of ABER which were quite stable. The normal number of superimposition for the recording of ABER should be more than 1,024 times so that all waves are clearly visible; however, due to the limited time of releasing emitted qi in this experiment, we reduced it to 256 times. Except Waves I and VII, all waves had a rather high rate of occurrence.

Normal ABER is composed of 5-7 waves. Each wave's amplitude is determined by its swing which is obtained from the trough of a wave and the peak of the next wave, and its latency is reached by the latency of its peak. Both are automatically tested and processed by the instruments, and the data are input to computers for computing the mean value, standard deviation and T-check.

The results of the physical effect test of emitted qi taken by the qigong master in this experiment confirmed him to be strong in the effect and very experienced in clinical treatment. When using emitted qi for induction, he could cause body movement on the testee.

## II. Results

1. Of the 12 sample recordings of the cat's ABER under the effect of emitted qi, two show distinct inhibiting effect, and the other ten all have an increase of ABER in various degrees, indicating the facilitating effect. To cope with the qigong master's time of releasing emitted qi, the number of superimposition is reduced from more than 1,024 times to 256 times. We do not include Waves I and VI, originating from the auditory nerve and the auditory radiation at the lower thalamus, respectively, in the calculation because their rate of occurrence is below 20 percent. The rate of occurrence of Wave II is 50 percent, Wave III 60 percent, Wave IV 70 percent, and Waves V and VI 100 percent. A normal cat's ABER is composed of 5-7 waves. The mean value of all wave amplitudes and all peak latencies recorded in this experiment basically agree with those recorded in other documents. The wave amplitude of a normal man's ABER is about 0.4-1.0  $\mu$ V, higher than that of the cat's ABER which is about 1-3  $\mu$ V. The peak latencies of a normal man's ABER are 1.5 ms for Wave I, 3.0 ms for Wave II, 4.1 ms for Wave III, 5.0 ms for Wave

IV, 6.5 ms for Wave V, 7.2 ms for Wave VI, and 8.3 ms for Wave VII. The peak latencies of the cat's ABER have a larger individual deviation, about 0.5-1.5 ms shorter than those of a man's ABER<sup>[20, 21]</sup>.

Of the corresponding peak latencies in all 10 sample recordings of the cat's ABER in this experiment, the mean value is 2.2 ms for Wave II, 2.97 ms for Wave III, 3.7 ms for Wave IV, 4.6 ms for Wave V, and 3.98 ms for Wave VI.

2. In the 10 sample recordings of ABER, all waves rise variably after being affected by emitted qi. The rise of Waves II and III are statistically insignificant. Wave IV rises by 30 percent,  $p = 0.05$ , Wave V by 30 percent,  $p = 0.01$ , and Wave VI by 33 percent,  $p = 0.05$ , all distinct as shown in Chart 1. The facilitating effect of brainstem is mainly seen between Waves IV through VI, or at the midbrain level, as shown in Diagram 1. It is most outstandingly exemplified by the 45-percent rise of Wave IV from 0.78  $\mu V$  to 1.4  $\mu V$ , the 54-percent rise of Wave V from 1.95  $\mu V$  to 4.21  $\mu V$ , and the 57-percent rise of Wave VI from 2.34  $\mu V$  to 5.39  $\mu V$ .

3. The change of the peak latency under the effect of emitted qi is quite interesting. In all the sample recordings, it extends variably along with the rise of the wave amplitude, and during the restoring period it keeps doing so while the wave amplitude is gradually returning to the contrast level. The peak latency of Wave IV extends from 3.69 ms to 3.77 ms and is 4.06 ms during the restoring period,  $p < 0.05$ ; of Wave V, from 4.61 ms to 4.74 ms and 5.09 ms during the restoring period,  $p < 0.05$  and 0.01; and of Wave VI, from 5.98 ms to 6.14 ms and is 6.80 ms during the restoring period,  $p < 0.05$  and 0.01. We can see that the higher degree of facilitation the wave amplitude goes, the more distinctly the peak latency extends, indicating that they are closely related to each other.

4. In two of the 12 sample recordings, the cat's ABER shows noticeable inhibition, see Chart 2 and Diagram 2. The wave amplitude is obviously lowering along with the extending of the peak latency. After being under the effect of emitted qi, the inhibiting effect stays for a relatively long time as it still is visible after 30 minutes and does not return to the contrast level until one and one half hours later. Its duration is much longer than that of the facilitating effect in the other 10 sample recordings. In one of the two recordings, the wave amplitude does not lower very distinctly, but the wave latency extends quite obviously.

5. The composition of the cat's MLR occurring between 10 ms and 50 ms is primary evoked responses of cortex whose normal latency is at an average of 17-25 ms. The latency determined in this experiment agrees with that recorded in other documents<sup>[22]</sup>. Under the effect of emitted qi, this composition has a rather sensitive influence, and causes the wave amplitude in all 12 sample recordings to change. The change has two forms, one is rising and the other lowering, each seen in six sample recordings, indicating that it can produce an effect which is facilitating as well as inhibiting. The two sample recordings of the inhibiting effect also show an inhibition of ABER. The latency in the team tested on the facilitating effect does not have an obvious change, but in the team tested on the inhibiting effect, not only does the wave amplitude lower, the latency also shortens. In the former team, the wave amplitude rises from 5.49  $\mu V$  to 7.03  $\mu V$ , or 22 percent,  $p < 0.05$ , and



one sample recording shows the rise from 4.06  $\mu$ V to 7.65  $\mu$ V, about 47 percent. In the latter team, the wave amplitude lowers from 6.49  $\mu$ V to 5.25  $\mu$ V, about 20 percent,  $p < 0.05$ . Most noteworthy is that while the wave amplitude is lowering, the latency shows an obvious shortening, from 26.6 ms to 23.1 ms,  $p < 0.05$ , as shown in Chart 3 and Diagram 3.

### III. Discussion

1. Many experimental studies have been done on how the wave of the cat's ABER are formed<sup>[20, 21, 22, 23]</sup>. The conclusions, though different, are generally identical. The ABER recorded on its scalp is far field potential which is the potential change recorded with the aid of volume conductor at separated locations. Its waves are slightly different in shape because the electrodes for the recording are placed at various spots; besides, the cat's ABER shows comparatively larger individual deviations in the wave latencies. Usually, 5-7 waves can be clearly recorded with a stimulation of sufficient strength and 1,204 times of superimposition. To make the observation of the facilitating and inhibiting effects an easy job, we used a 70-80dB stimulation and superimposed 256 times in this experiment. The causes of the formation of the cat's ABER waves are confirmed by the method of correspondingly directing destruction into its nerve system or auditory nerve nucleome. Sohmer<sup>[24]</sup> and Buchward<sup>[23]</sup> have been confirmed Wave I to be a far field potential of the auditory nerve's action potential and Wave II an electrical activity of the bilateral cochlear nucleus. These two waves might represent the central activity at the mudullary bulb level. The interpretations of Wave III are not unanimous. In human body, it is known to be generated by the activity of the nucleus of lateral horseshoe series, but many researchers advocate that in cat it is caused by the electrical activity of the superior oliva<sup>[25]</sup> because it may disappear when the superior oliva is destroyed; thus, it is equivalent to the electrical activity at the pons level. Wave IV is known to be generated by the electrical activity of the bilateral inferior colliculus which is equivalent to the electrical activity at the midbrain level. There still is divergence of opinion about how Wave V is formed. Some people believe it is a result of the electrical activity of the bilateral inferior colliculus caused by the mutual transmission between left and right inferior colliculuses because when the sound is stimulating one side and destroying the bilateral inferior colliculus Wave IV still exists but Wave V disappears<sup>[26]</sup>, but others think that Wave V is possibly an activity of the lateral geniculate body's potential. No final conclusion has yet been reached on how Waves VI and VII in the cat's ABER are formed. However, since it is known to us that Waves I through V continue to stay and Waves VI and VII disappear after the brain ceases its function at the superior colliculus level, we guess that Waves VI and VII are above the midbrain level, equivalent to the electrical activity at the lower part of the thalamus.

2. Emitted qi obviously facilitates the cat's ABER as a certain degree of facilitation is found in all 10 sample recordings. It is most distinct in Waves IV, V and VI and not really noticeable in Waves II and III even though a slight rise is found in their amplitudes. This phenomenon explains that facilitation occurs mainly at the midbrain level instead of enhancing from the bottom to the top, and confirms that emitted qi has a selected function above the midbrain level. In three sample recordings, the facilitating effect is also found in Wave VII which is the wave denoting the appearance of

responses at the hypothalamus level. In the cat's ABER, Waves IV and VI indicate the activity at the midbrain level, and Waves VI and VII the activity above the midbrain level, mainly at the hypothalamus level. This fact is of vital significance for further explaining that the function of emitted qi can cause synchronization of the alpha rhythm in EEG and the expansion of the alpha power spectrum<sup>[10]</sup>. It is known that the synchronized electrical activity of EEG is the consolidated potential of EPSP and IPSP at the parietal dentrite of cortex caused by the oscillation in the circuit of nerons at the hypothalamus level through the synchronizing network of neurons also at the hypothalamus level; hence, emitted qi possibly impact on EEG through the facilitating effect at the hypothalamus level. On the other hand, emitted qi facilitating at the brainstem level might also be the reason why it can affect the activities of internal organs because the regulating center for those activities is mainly located at the hypothalamus and the brainstem.

3. Although it is still difficult to explain how the effect of emitted qi influences the peak latencies of all ABER waves, the changes are quite noteworthy. It is known that when its intensity is enhanced, the stimulation not only causes all wave amplitudes to rise to a certain extent but also correspondingly shortens all wave latencies. Under the effect of emitted qi, except Waves II and III which show no obvious change in their amplitudes and latencies, Waves IV, V and VII are correspondingly extending their latencies while the amplitudes are expanding and keep doing so during the restoring period. The expanding of all ABER amplitudes means the heightening of the level of the synchronized activity of the related cells in the central nucleome, and the peak latency between the waves represents the transmission speed between the related neural nucleomes. Obviously, emitted qi has the function of heightening the level of the activity of neural cells and lowering the transmission sped between nerons, which might be helpful for us to explain that the effect of emitted qi causes low-frequency, synchronized activity to occur. It is not uncommon to find such a disagreement between the changes of wave amplitudes and latencies in the central nerve system. For example, when man is in states I and II of sleep, the amplitude of all slow auditory cortex responses having a 200-ms latency shows a double rise, and the latency extends obviously<sup>[27]</sup>. The disagreement between the changes of amplitudes and of latencies and the significance of the mechanism need to be further probed.

4. Waves IV, V and VI in two sample recordings of the cat's ABER show a noticeable inhibition coupled with an obvious extension of the latency when affected by the effect of emitted qi. Although they are the only two cases found in the 12 sample recordings, the changes are quite obvious. This experiment has the attempt of trying to probe the "stimulating" effect and "inhibiting" effect of the qigong master's idea at the time of releasing emitted qi. Of the five tests on his idea's "stimulating" effect, only two show the inhibiting effect, while the other three still have the facilitating effect. Although the qigong master's subjective idea and the objective results are not completely identical, we can at least confirm that emitted qi has a bidirectional effect on the central nerve system, that is, emitted qi is proven to have the ability not only to facilitate but also to produce the inhibiting effect. Evidently, this fact is of vital significance for explaining emitted qi's mechanism of regulating organic systems. Of course, we cannot eliminate the deviations in animal's individual responses. The

results of this experiment have provided the experimental basis for us to further study the effect of qigong master's "idea," which is the topic of this laboratory's next research.

5. Auditory evoked responses are classified into three categories in accordance with their latencies: responses having a short latency of less than 10 ms (ABER); responses having a middle latency of 10-50 ms, and responses having a long latency of 50-300 ms, also known as slow vertex responses (SVR). The latency of the cat's MLR is about 17-25 ms. MLR are the activity of potential caused to occur by the lateral geniculate body of the hypothalamus and by the auditory radiation when reaching the primary auditory cortex, and they are the primary composition of the evoked potential and represent the auditory cortex in the activated state<sup>[28]</sup>. The surge of potential of the cat's auditory middle latency evoked responses is a slow surge of negative potential which is called A wave<sup>[29]</sup>.

In regard to the influence of emitted qi on the cat's MLR, one half of the 12 sample recordings show the facilitating effect and the other six the inhibiting effect, indicating that emitted qi also produces bidirectional effect on the cortex. Two of the six sample recordings of the inhibiting effect show the same inhibiting effect in ABER, but it is not fully identical to the result produced by the qigong master using the method of "inhibiting" power. Even though his subjective "idea" and the objective effects are not in total agreement, emitted qi is confirmed to be able to facilitate and inhibit the activity of the cortex. We, however, still cannot determine whether this ability is totally caused by the difference of emitted qi's effect or by the deviation of animal's individual responses, or is a mixture of subjective "idea" and objective effects, but we have at least pointed out to the researchers the possibility of using animal as the object of experiment to further study the different effects in emitted qi's mechanism. There is a similarity between this phenomenon and the results of our experimental study on normal human's evoked responses under the effect of emitted qi<sup>[9]</sup>.

6. In this experiment, we for the first time used anesthetized animal to prove the objective effects of emitted qi on the central nerve system, from the brainstem to the brain cortex, thus confirming that the biological effect on human body caused by emitted qi is not totally psychological in nature. In the meantime, we have provided the basis for researchers to use animal as the object of experiment to further study the mechanism of emitted qi's central effects and the effects produced by qigong master using different power methods, and have pointed out the objective norm of the study on the effect of qigong master's subjective "idea."

#### Brief Conclusion

This experimental study has proven that emitted qi has distinct influence on ABER and MLR in anesthetized animal and presents its function in two forms: the facilitating effect and the inhibiting effect, and that it can directly function at the midbrain level and change its activity by facilitating and inhibiting. Not only does this fact explain the objective existence of the effect of emitted qi, it also shows that its impact on the central nerve system in human body, especially on the cortex of brain, is not totally a

psychological effect. In the meantime, it points out the objective norm of future studies on the functions of a subjective factor, that is, the mechanism of emitted qi's central effect and the different power methods adopted by qigong master.

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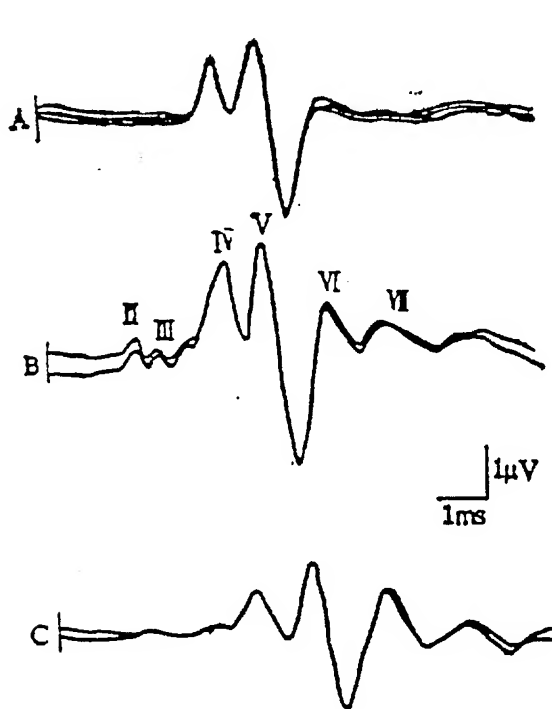


Diagram 1

Facilitating Effect of ABER

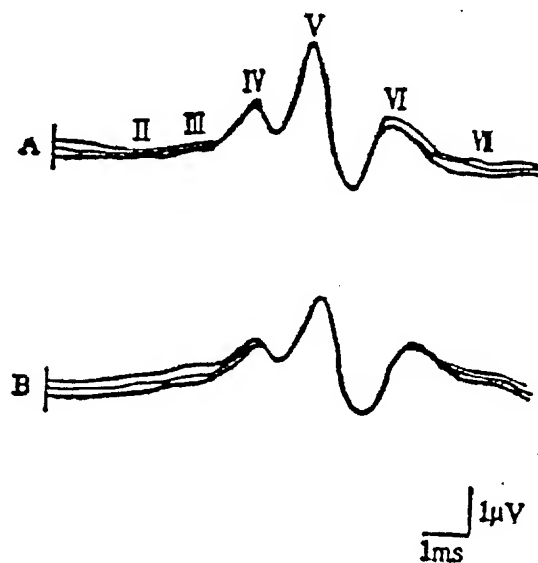


Diagram 2

Inhibiting Effect of ABER

A - Contrast

B - During the Effect of Emitted Qi

C - After the Effect of Emitted Qi

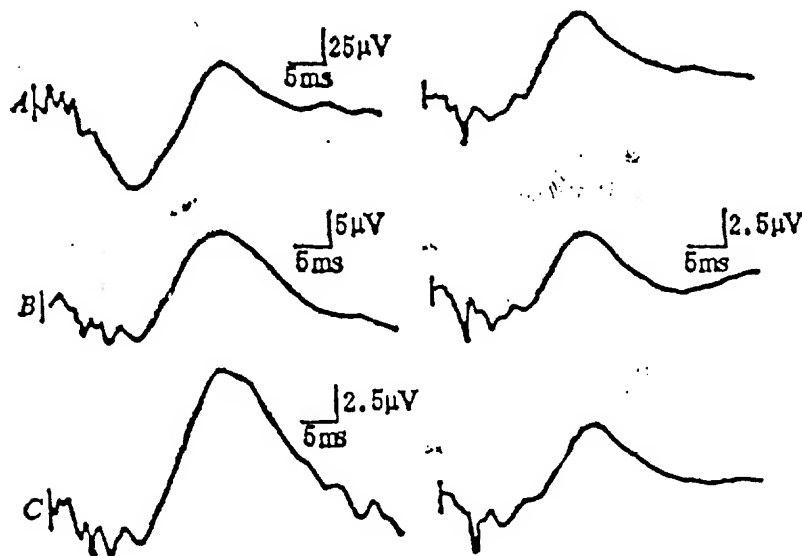


Diagram 3

The Influence of Emitted Qi on MLR

A - Contrast B - During the Effect of Emitted Qi C - After the Effect of Emitted Qi

Left

Right

Chart 1

	I n=5		II n=6		IV n=7		V n=10		VI n=10	
	A	L	A	L	A	L	A	L	A	L
B	0.71	2.20	0.89	2.97	1.23	3.69	2.70	4.61	1.82	5.98
D	0.90	2.17	1.22	3.0	1.87*	3.77*	2.90**	4.74*	2.70*	6.14*
A	0.81	2.34	0.89	3.29	1.08	4.06*	2.30	5.09**	1.72	6.80**

B: Before

D: During

A: After

\*  $p < 0.05$  \*\*  $p < 0.01$  A( $\mu$ V) L(ms)

Chart 2

Sample Recording	Wave IV						Wave V		
	A( $\mu$ V)			L(ms)			A( $\mu$ V)		
	B	D	A	B	D	A	B	D	A
8	1.25	1.09	0.39	4.28	4.48	5.16	2.34	1.79	0.85
11	0.43	0.56	0.32	4.56	6.50	4.72	2.18	1.41	1.48
Average	0.84	0.82	0.20	4.42	5.49	4.94	2.26	1.6	1.17

Sample Recording	Wave V			Wave VI					
	L(ms)			A( $\mu$ V)			L(ms)		
	B	D	A	B	D	A	B	D	A
8	5.36	5.76	6.6	1.56	1.79	0.85	7.76	7.72	8.64
11	6.2	7.68	6.6	0.78	1.01	0.47	8.76	10.0	8.84
Average	5.78	6.72	6.6	1.16	1.40	0.66	8.26	8.86	8.74

Chart 3

	Facilitating Team		Inhibiting Team	
	A $\mu$ V	L ms	A $\mu$ V	L ms
B	6.49	25.7	5.49	26.6
D	5.25*	26.9	7.03*	23.1*
A	6.22	27.4	5.43	27.7

\*  $p < 0.05$

FINE STRUCTURAL OBSERVATION OF EMITTED QI  
EFFECTIVE ON CANCER OF LUNG OF MOUSE

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Lung cancer is a common malignant tumor, which presents a menace to human life. In recent years, using the emitted qi from the traditional medical science to treat lung cancer has gained certain curative effect. In order to make a further probe into the killing mechanism of the emitted qi against the cancer cells, we have made a simulated clinical treatment by selecting a qigong master to apply the method of using his emitted external qi against a mouse inoculated with a tumor substance in its lung. Following are the details of the preliminary experiment:

I. Materials and methods

Twenty four C<sub>57</sub> purebred mice and the Lewis lung cancer liquid are used. Each mouse is inoculated 0.2ml of the liquid at the axilla under its right front limb. The treatment starts 24 hours after the inoculation. The inoculated mice are divided up into several teams for treatment as below: Team 1 of six mice will be treated with 30mg/kg of cyclic phosphoryl amide each per day; Team 2 of six mice will be treated with 0.2ml of physiological saline each per day; Team 3 of six mice will be treated with external qi emitted by a qigong master 10cm away from each mouse per day, lasting invariably between 20 and 60 minutes each time; Team 4 of six mice which will be kept just for observation and comparison will not receive any treatment. The treatments mentioned above will go on for two weeks; while the tumor in each mouse will have a different degree of growth. Drawing of materials will be based on the mouse's natural biological life. Considerations must be given to avoid the physical changes after death when the mouse is being inspected under an electric magnifier. Therefore, it is necessary to observe closely the mouse's growing status. In general, materials are drawn right before the mouse is on the verge of dying. The mice from each team will have a different sizes of tumor growth. The number of their surviving days is also different. Before the materials are going to be drawn, the tumor should have an intact exterior membrane. Get several pieces of the light red tumor tissue at a size of about 1mm from the cross section, which are showing certain growth, and immediately solidify them in a 3.75 percent glutataldehyde solution and then in a one percent osmic acid before dehydrating them in regular acetone. Then wrap them up in Epon 812 resin, before cutting them into lum pieces with position fixed by an optical microscope. Use LKB-NOVa microtome to cut them into 500--600 A slices, which will be placed in a dyestuff made of uranium acetate-lead citrate. Observe them through an EM-1200 Ex fluoroscope.

II. Results

A. The Team Under the Treatment of Cyclic Phosphoryl Amide

The cancer cell drawn from the tumor tissue grows actively. The cancer cells stay together closely in a circle approximately 15--20um in size, with



a core at the size of two thirds of the cell and full of chromosome. The plasmosome is protruding, with some of it bearing to one edge. The cancer organelle does not have much cytoplasm. Swollen mitochondria are easily visible, with Golgi organ and endoplasmic reticulum often expanded. Occasionally small particles of secondary lysosome are visible. The split up cancer cell often has minute villus on its surface, with a tendency of forming adeno structure in certain area. Karyokinesis of the cancer cell is easily visible. Necrosis of the cancer cell is not taking place (see Chart 1).

B. The Team Under the Treatment of Physiological Saline and the Team Kept Just for Observation and Comparison

Both teams are under a similar shape; but the cancer cells are growing very actively, with karyokinesis of cells easily visible. In the second team, one cancer cell is seen eroding the capillary, partially destroying the capillary.

C. The Team Under the Treatment of Emitted External Qi

The cancer cells are round with an easily visible degrading status and the appearing of lysosome in large volume. The lysosome, in bubble or irregular shapes, initially appears around the nucleus. Gradually it begins to combine into a large massive, with part of it becoming autolysosome, comprising of degenerated mitochondria and membrane structure. When severely degenerated, large lysosome with a size one third of the cell will appear in the cancer cell. It will no longer have its plasma. Its membrane is destroyed. Its nucleus structure becomes obscure, or apparent pycnosis status (see Chart 2). Part of the local cells can hardly be distinguished. As a result, several neighboring cancer cells which exist next to one another only in broken pieces appear in a serious state of necrosis (see Chart 3). In the area of necrosis, inflammatory cells such as macrophages are not appearing.

III. Discussions

Using emitted external qi to treat human diseases has begun to take shape. Examples of using traditional qigong to treat chronic diseases are nothing new. The Naval General Hospital's Immunity Research Office has spent a lot of time in studying the theories of immunity through the use of qigong, and successfully revealed the distinctive power of the emitted external qi in killing germs and virus. At the same time, observations (1-3) made through the use of a scanning electron microscope of the morphogenesis of the cultured stomach cancer cell treated with the emitted external qi have taken place. These researches have aroused much enthusiasm of both domestic and foreign scholars.

This experiment involves the creation of an animal model with a physical lung tumor by inoculating subcutaneously the mouse with Lewis lung cancer liquid. A qigong master will emit 20--50 min of external qi against the model animal daily. The mouse will be under a close observation on how effective the emitted external qi will be against its tumor cells. Another mouse treated with cyclic phosphoryl amide will be used for comparison. All 24 mice will be placed under a submicron structure observation to compare the differences of submicron changes among the teams.

It is discovered that under the electron microscope, the images of the team treated with emitted external qi differ from the images of the team treated with cyclic phosphoryl amide. The state of necrosis clearly appears with the former, even though the materials are drawn right before death; while the said state of necrosis does not appear with the latter. On the contrary, the growth of cancer cells is very active with visible sign of karyokinesis. As to the team treated with emitted external qi, the degeneration and degradation of cancer cells are easily visible, even the necrosis of cancer cells in large areas. What is more obvious is the ever growing of the lysosome (-GL-)Qin the cancer cells, which has attracted our attention.

A lysosome is a kind of organelle existing in the animal cells. Its functions have been positively established. It is surrounded by the lipoprotein membrane, which contains a large volume of decomposable protein, nucleic acid, and lipid hydrolytic enzyme, mainly responsible for the digestive functions within the cell. This potent "digestive organ" contains more than 40 different kinds of lipid hydrolytic enzymes. The hydrolysis process of cells by the lysosome is completed under the germless condition. Once a cell is under certain attack and stimulus, the lysosome will immediately release different kinds of hydrolytic enzymes, and begin to digest the cell composition. When the cell is facing various fatal attacks, the lysosome often becomes highly active, and quickly self dissolves the injured cell to complete the process of "self-destruction." An electron microscope examination of the cell immediately after its death indicates that its minute structure no long exists. This is a typical example of the function of the lysosome.

In the result of our experiment, we have seen the active growth of lysosome in the cancer cells of the mice treated by the emitted external qi, which causes the destruction of cancer cells in large numbers. This has aroused greatly our interest.

The emitting of external qi is based upon a human being who, under the qigong state, tries to maneuver consciously the internal qi and concentratedly emits from certain acupoint or certain part of the human body a fixed intensity and density of substance energy such as bioelectricity and bioenergy. Following the scientific and technological development and the use of new instruments and equipment in recent years, people have tested the biological mechanism of the emitted external qi and gained an objective medical index. For instance, both Atomic and Nuclear Research Institute and Dynamics Research Institute of Chinese Academy of Science have discovered the thermal effect of the cross current between signal and pulse when a qigong master is emitting the external qi from his hand. This has proved that the actual existence of external qi is beyond doubt.

The treatment of tumor has been a difficult point of modern medical science. Numerous feasible tests are being developed in many research units. The purpose of applying our traditional medical science in carrying out a series of experiments by using emitted external on animals is also to further understand and explore the treasure of China's medical science for the welfare of mankind. As to how the external qi emitted by a qigong master can stir up

the lysosome system within an animal's cancer cells, so far there is no explanation. Further research and probe are still needed.

#### Conclusion

This article probes, from the angle of animal experiment, the feasibility of using emitted external qi to treat the lung cancer tumor. It also presents, from the angle of cell's minute structure changes, the active growth of lysosome system after the treatment of emitted external qi as the main reason of cell necrosis.

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Chart 1 The Team Under the Treatment of Cyclic Phosphoryl Amide.

It shows an integral shape of the cancer cells, which grow actively with a visible karyokinesis of the cancer cell. (6000x)

Chart 2 The Team Under the Treatment of Emitted External Qi.

It shows an irregular shape of the cancer cells with the increase of empty membranous cells in cyto, which are in a state of degeneration. (11000x)

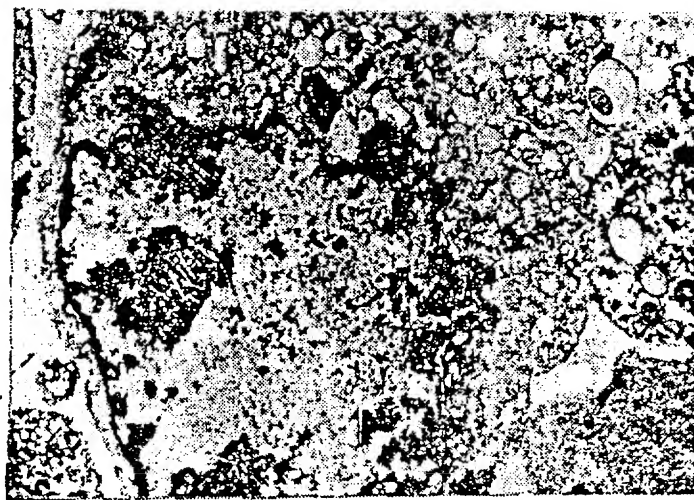


Chart 3 The Team Under the Treatment of Emitted External Qi.

It shows that the cancer cells are in a serious state of necrosis. The cyto is completely dissolved. (11000x)



THE OBSERVATION OF EMITTED QI  
ON THE CYTOPLASM ACTIVITY OF THE HYDRILLA VERTICILLATA

[Zhang, Zuqi (South China Normal University)]

Summary

After the master has emitted the "external qi" on a hydrilla leaf, observation under the microscope indicates an accelerated flow of the protoplasm of the mesophyll cells. This may reflect that under the effect of the emitted "external qi," the cell's metabolism is more vigorous than usual.

The experiment proves that "external qi" emitted by a master creates a certain effect on the development and growth of animal, plant, and microorganism. Feng Lida et al (1)(2), through the observation of the effect of "external qi" emitted on Gram's female bacillus and Gram's male coccus, have discovered that the "external qi" emitted by a master with a lethal concept will have a fatal effect on colibacillus, dysentery bacillus, white staphylococcus, and golden staphylococcus. If the "external qi" is emitted on colibacillus and dysentery bacillus with a concept of hyperlasia, it will help both of them grow. Li Caixi, Luo Zhibiao et al (3)(4), through an observation of the effect by emitting "external qi" on myocardium cells cultured outside the body, have discovered that the "external qi" will create a biological effect on the myocardium cells cultured outside the body. It may regulate the cell's pulsing frequency, improve the irregular rhythm, and improve the pulsing intensity. Most recently, Xie Huanzhang et al (5), through an observation of a master's emission of "external qi" on the seeds of beets, soy beans, barley and grain, have discovered that it is affecting the growth of the plants, with increased products from both beets and soy beans. Zhang Zuqi et al (6), through an observation of the effect in having a master emit "external qi" on soaked paddy rice seeds, have discovered that the seeds with "external qi" emitted on will generally sprout earlier and grow more vigorously than those without "external qi" emitted on.

The effect of "external qi" of qigong on organism probably is a result of its function on the cells within the organism, by increasing the cell's metabolism or even causing certain structural changes to take place within the cell. We are using hydrilla as our material to observe the effect of "external qi" on the flow of cyto within the hydrilla cell, and to find out the relationship between "external qi" and the cell's internal changes.

I. Materials and Methods Used

The materials used are hydrilla (*Hydrilla Verticillata* (L, f) Royle) (Chart 1). The characteristics are that the leaf's surface cells are transparent. Under a microscope, one can see the orderly arranged leaf cells, which contain particulate chloroplast with a large vacuole in the center. One can see a live cell's cytoplasm is flowing at one direction along the outer edge of the vacuole, carrying within it the chloroplast. Therefore, observing the circular flow of the chloroplast will reflect the activity of the cytoplasm.

The method used is to select a tender hydrilla leaf each experiment,

place it on a piece of glass, add a little water, and then cover it with another piece of glass. Observation takes place through a microscope (400x). During the observation, look for a mesophyll cell (Chart 2 and Chart 3) in the vicinity of the vein, and use an indicating needle and find a fixed point on the cell's vacuole.

When the experiment of each team starts, select a person who is not a qigong master, ask the person to put one of his hands 10cm away from the glass, and ask him to count how many chlorophylls outside of the vacuole have passed through the fixed point in one minute. After a period of time, ask a qigong master to stand at a similar distance, point his index and middle fingers together at the leaf and emit "external qi" on the leaf. At the same time, ask him to count how many chlorophylls have passed through the fixed point in one minute. This comparison (without the emission of "external qi") and test (with the emission of "external qi") will be considered as a team. After each test, each team gets a new cell. When 2--3 teams have had their tests, there will be a new leaf. The room temperature will be recorded during each experiment.

## II. Results

From 10 March to 16 April 1987, we asked master Ke Heng to emit "external qi" on a total of 70 teams, and observed a total of 70 cells with the results shown in Charts 1--5 below:

Of the above-mentioned 70 teams put under the experiment, the number of chlorophyll in the hydrilla's mesophyll cell passing through the fixed point each minute will be represented by  $\bar{a}$  as the average value for the team of comparison, and  $\bar{b}$  for the team emitted with qi. Then  $\bar{a} = 8.90$ ,  $\bar{b} = 17.67$ ,  $\bar{b} - \bar{a} / \bar{a} \times 100\% = 98\%$ . This indicates that the average value of the chlorophyll passing through the fixed point each minute for the team emitted with qi will increase by 98% than that of the team of comparison. And the difference is notable.

## III. Discussions

1. By observing the chlorophyll in the hydrilla's mesophyll cells passing through the fixed point, we can tell that a qigong master after emitting "external qi" on the mesophyll cell will cause the number of mesophyll cell passing through the fixed point to change; while the flow of chlorophyll has reflected the flow of cyto. Therefore, we may assume that after the "external qi" has worked on the hydrilla's mesophyll cells, it can cause the flow of cyto to change. The function of the "external qi" emitted by Ke Heng is to accelerate the flow of cyto. This kind of accelerated flow may reflect that the metabolism within the cell is more active than it was during the normal time.

2. Studying the function of qigong's "external qi" on organisms has a certain meaning in understanding the function of qigong and the essence of "qi". And the effect of "external qi" on organisms may very well affect certain metabolism process or structural changes to take place within a cell. From the experiment conducted on the team mentioned above, we have observed the effect of "external qi" on the activities within a cell. This calls for a more direct and realistic study of the relationship between "external qi" and organism's cell activities. If this research work takes a

further step and considerations are given to combine it with the integral function of "external qi" on organisms, it has provided a new path<sup>(1)</sup> for the study of qigong.

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(1) indicates that instructor Pei Zhaohua of the Department of Electronic Education of Hua Nan Normal University has participated in part of the research work.

Chart 1

Date	Room Temperature	Team Number	Number of Chloroplasts Passing Through a Fixed Point Each Minute	
			Team of Comparison	Team Emitted with External Qi
Morning of 10 March 1987	26°C	1	10	17
		2	11	18
		3	11	19
		4	10	20
		5	12	20
		6	10	18
		7	11	18
		8	11	19
		9	10	17
		10	11	18



Chart 2

Date	Room Temperature	Team Number	Number of Chloroplasts Passing Through a Fixed Point Each Minute	
			Team of Comparison	Team Emitted with External Qi
Morning of 17 March 1987	27°C	1	12	18
		2	10	17
		3	12	18
		4	12	18
		5	11	18
		6	11	17
		7	11	19
		8	10	20
		9	11	20
		10	12	20
		11	11	20
		12	10	18
		13	11	18
		14	10	17
		15	10	18

Chart 3

Date	Room Temperature	Team Number	Number of Chloroplasts Passing Through a Fixed Point Each Minute	
			Team of Comparison	Team Emitted With External Qi
Morning of 19 March 1987	24°C	1	8	15
		2	8	16
		3	7	16
		4	8	16
		5	7	15
		6	7	15
		7	8	17
		8	8	18
		9	7	18
		10	7	17
		11	9	18
		12	9	19
		13	8	16
		14	8	18
		15	7	17

Chart 4

Date	Room Temperature	Team Number	Number of Chloroplasts Passing Through a Fixed Point Each Minute	
			Team of Comparison	Team Emitted With External Qi
Morning of 31 March 1987	25°C	1	9	17
		2	9	18
		3	8	18
		4	8	19
		5	8	19
		6	9	20
		7	9	20
		8	8	20
		9	8	18
		10	8	19
		11	9	17
		12	9	17
		13	8	18
		14	8	17
		15	8	18

Chart 5

Date	Room Temperature	Team Number	Number of Chloroplasts Passing Through a Fixed Point Each Minute	
			Team of Comparison	Team Emitted With External Qi
Morning of 16 April 1987	21°C	1	7	16
		2	8	17
		3	7	17
		4	8	18
		5	7	18
		6	8	19
		7	7	19
		8	7	20
		9	8	20
		10	7	17
		11	8	16
		12	8	18
		13	7	19
		14	7	17
		15	7	17



Chart 1 A Hydrilla Branch

Chart 2 Mesophyll Cells in the  
Vicinity of the Vein  
100x

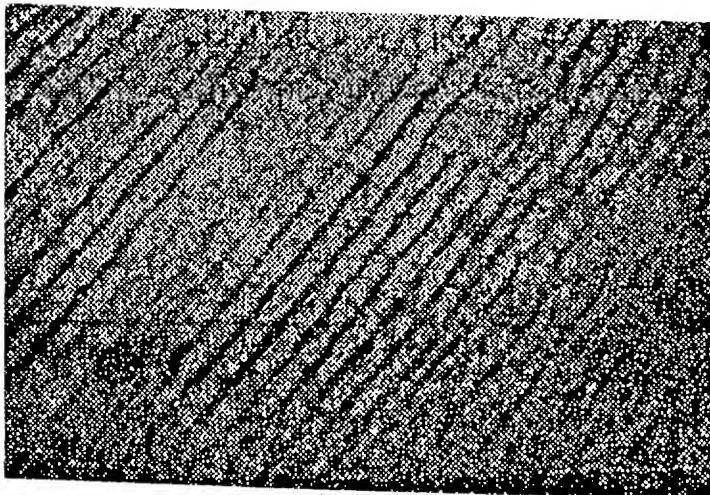
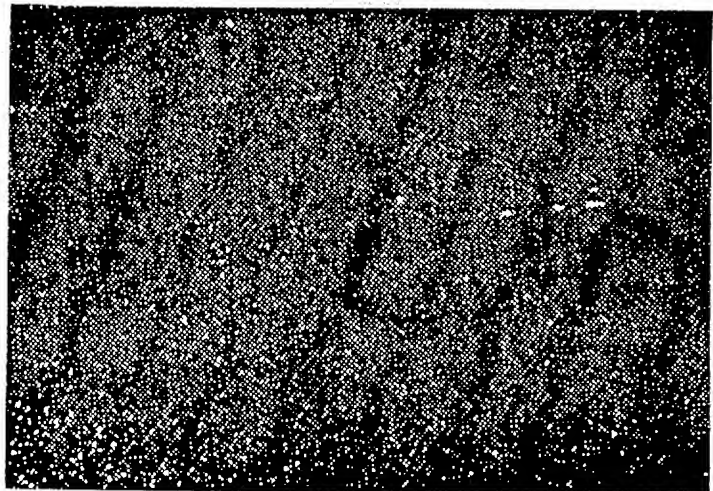


Chart 3 Hydrilla's Mesophyll Cells  
(The Dark Spots in the Cells  
are Chloroplasts.) 400x

## Probe of Measuring Biological Effects of External Qi of Qigong with the Tradescantic Paludosa Micronucleus Technique

Sun Silu, Tao Chun, Tian Wenpin, Su Diange and Wang Likuei  
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As an objectively existing matter, energy, and information, Qigong has effects on animals, plants and micro-organisms proven by scientific experiments [1,2,3]. Effects of external Qi of Qigong are produced by the Qigong practitioner with controlled thoughts. Therefore, Qigong effects are directional [4].

With the tradescantic paludosa micronucleus technique, we tested the effects of external Qi of Qigong on chromosomes and determined that the effects are bi-directional. The external Qi of Qigong can protect chromosomes, reduce poison levels and reduce micronucleus rates. However, it can also destroy chromosomes and raise the micronucleus rates.

### I. Theory and Method

1. The Tradescantic Paludosa Micronucleus Technique was invented by Professor Matthews [5] from Illinois State University of the United States. In 1980, he introduced the technique to our country and monitored environmental pollution with the cooperation of Professor Fang Zong Xi [6] from Shan Dong Oceanology Institute. The theory of this technique involves using the chromosomes in the meiosis process of the female pollen cells of Tradescantic Paludosa as the attack targets of the experimental elements and to use the micronucleus produced by the tetrads formed from subtrahend division as the monitoring index. This technique has advantages of being sensitive, effective, quick, and economical. The following are specific operational steps and theories:

(1) Put a few inflorescences taken fresh from a nursery into some bottles filled clean tap water. Culture in water for a stable period of three hours which will be guarantees stable and unified conditions (or factors).

(2) Continue culturing for six more hours for the poison test period. During this period of time, the inflorescences can be treated with different kinds of poison tests. If a chemical reagent is to be used, put the flower stems into the solution of water and the chemical reagent.

(3) After six hours of culturing, change the water to clean tap water. Continue culturing for twenty-four hours as a recovery period. During this period, the destroyed chromosomes produce micronuclei when forming tetrads after the subtrahend division process.

(4) At the end of the recovery period, use Carnoy's fixative to fix inflorescences. After twenty-four hours, put the inflorescences into 70% alcohol to ready them for the microscope exam.

(5) Dye the inflorescences with improved red phenol acid dye liquor and examine in slides under a microscope. Determine results.

2. The external Qi came from performances of Tao Chun and Su Diange, Qigong teachers from our institute; Tian Wenpin, a doctor out of the Qigong Clinic; Wang Likuei, a martial arts teacher from Weifang Arts School. Before the experiment, CT-3A [haotelasiji--transliteration of Chinese term] was used to measure the intensity of magnetic induction of Laogong acupoints of these four. In order to guarantee enough external Qi for the experiments, it was decided that four people would release Qi simultaneously, and then cooperatively use the external treatment of the experiment. They provided Qi from the Laogong point for ten minutes, their palms being 10 to 30 cm from the inflorescences.

### 3. Two External Qi Tests.

(1) Test for protection of the chromosomes with external Qi. This was done using four groups. Tradescantic Paludosa were cut and cultured in water as described above. They were given a six hour poison treatment (48 ppm) induced chemical reagent  $\text{NaN}_3$  solution, which destroyed their chromosomes. The external Qi protection treatments were given to four groups at different time periods. With group one, the inflorescences were treated by external Qi during the stable period before the poison treatment. Group two was given external Qi during the poison treatment. Group three was given external Qi to protect the inflorescences after the poison treatment. Group four, by comparison, was never treated with external Qi. Controlled thought, when releasing external Qi, was given to protect the chromosomes.

(2) Test for Destruction of Chromosomes by External Qi: This was done in two groups. The Tradescantic Paludosa were cultured only with clean tap water without any other reagents. Group one was given external Qi during the corresponding stable poison treatment and recovery time periods described in the previous test. Controlled thought was used to destroy the chromosomes. Group two by comparison was not treated by external Qi.

## II. Results and Discussion

1. Test results are listed in the table below.

### Bi-Directional Effects of External Qi on the Chromosomes of the Tradescantic Paludosa

Tests	Test Groups	Tetrad Observed	Tetrad with Micronuclei	Micronuclei Appearing %	$\chi^2$	p Value
Protection Tests	Group 1 Stable Period Qigong	2401	64	2.67	9.38	$p < 0.01$
	Group 2 Poison Period Qigong	2500	78	3.12	4.65	$p < 0.05$
	Group 3 Recovery Period Qigong	2500	86	3.44	2.32	$p > 0.05$
	Group 4 No Qigong given	2506	107	4.27		
Damage Tests	Group 1 Qigong given 3 times	2492	139	5.58	9.24	$p < 0.01$
	Group 2 No Qigong given	2498	84	3.76		

It is shown in the table that in the external Qi protection test, chromosomes were protected with external Qi before being treated with the poison reagent. The appearing rates of micronucleus obviously decreased. There is a big difference in appearing rates between this group and the comparison group ( $p < 0.01$ ). Therefore we conclude that external Qi obviously has a protecting effect on the chromosomes. In group two, the chromosomes were given protection by external Qi while being treated with the poison reagent. There was also an obvious difference in the appearing rate of the micronuclei between this group and the comparison group ( $p < 0.05$ ). It was shown that there is a protective effect given by external Qi on the chromosomes. In group three, the chromosomes were given protection with external Qi after being treated with the poison reagent. There was no obvious difference between this group and the comparison group.

In the external Qi destruction test, there was an obvious difference in the appearing rates of the micronuclei between the groups treated by the poison reagent and the group without poison treatment ( $p < 0.01$ ). Therefore, it is proven that external Qi has an obvious destructive effect on chromosomes.

## 2. Discussion

It is proven in our tests that external Qi has obvious bi-directional effects on the chromosomes of Tradescantic Paludosa. It not only has a protective effect, but also a destructive effect. These bi-directional effects of external Qi were produced by Qigong generators with controlled thoughts. Therefore, it may be said that the nature of external Qi is informative. The effective directions of ex-



ternal Qi and the directions of the thoughts of Qigong generators are consistent.

It was shown in our tests that external Qi had obvious protective effects on genetic matters before or while being treated with a poison reagent. The protective effect was not as good after the poison treatment. This indicates that Qigong can be used in health protection as well as in curing disease. The principle of prevention and early treatment should be given special attention when Qigong is used in prevention and cure of cancer along with chemical and radiation treatments.

In the Tradescantic Paludosa technique, the appearing rate of the tetrads is used as the monitoring index. The high or low appearing rate of micronuclei to a certain extent can reflect the intensity of the affecting factors. Therefore, the fixed quantity of this technique can be used to measure the amount of external Qi generated by Qigong generators. A method of biological measurement can thus be established.

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## Visualization Study of Effects of External Qi

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### Summary

This article describes the visualization of the external Qi field from the body by using the technique of flow display. This illustrates for the first time external Qi phenomenon that can not be observed directly by human eyes or by any other perceptive sense. It also presents a flowing pattern of the external Qi field of the human hand. The article first describes the basic theory of the visualization method. It gives an overall layout of the experiment. At the end it analyzes observation results from external Qi emitted by Qigong generators. The existence and effects of external Qi can be observed clearly from the figures in this article. Thus, it provides us with a basis for the study of Qigong's mechanism.

### Introduction

With formation of "Qigong heat" waves, studies of Qigong's mechanism have increased. In recent years, scientists coordinating with Qigong masters have probed external Qi information from the body from different angles. It is felt that the external Qi field has infrared radiation, electrostatic, low frequency magnetic, infrasonic sound, biophysics, and biochemical effects. It is also felt that external Qi is a substance field as well as biological energy field. Emission of external Qi can give a receiver's body hot, cool, tingling, swelling, sore, bug-crawling sensations as well as electric shocks. There have been many articles reporting the cases of cure of diseases with external Qi treatment. For instance, some incredible curative effects have been gained on diseases such as cancer. However, it is felt by some people that there is not enough basis for the substantial qualities of external Qi. So-called external Qi is only increased amounts of blood in certain parts of the Qigong generator's body which causes changes of the so called "heat". Under such circumstances, even with the existence of other substances, the amount is not enough to produce any specific effects.

Besides the measuring studies described above concerning the probe of external Qi's mechanism, the question remains as to whether we can change invisible phenomenon into visible. That is to say, to make it possible for people to "see" the external Qi phenomenon. The question of visualizing the external Qi field also remains. To visualize the external Qi field is to show all information of the affecting Qigong field in a way perceptible through senses using specific methods and special equipment. This technique is known as Qigong visualization. The picture resulting from Qigong

visualization can help us know the properties of Qigong. It also helps us to establish mathematical models for the study of Qigong field theory and to make simulated models of external Qi to help cure human diseases.

Since 1979, we have been observing external Qi emitted by Qigong masters from Shanghai, Beijing and Xian. We have also videotaped what we have observed of the external Qi field.

### I. Basic Theory

Until today, the properties of external Qi have not been known completely. Information can not be gathered completely by measuring techniques in use at present. A difficult problem for scientific researchers remains to make the results include most of the information gathered from the external Qi field. In order to probe into the external Qi field problem. We first visualized the flow of the external Qi field from a hydro-kinetic point of view. Our patients were given treatment in a non-contact situation since Qigong doctors can emit external Qi at a distance. It can be inferred that there is "flow of external Qi" from the point of the Qigong doctor. Therefore there is an inferred flow field existing between the Qigong doctor and the patient. We can use the optics method to visualize it.

It is well known that as a light ray goes through a density changing medium field, its direction changes due to refraction. An angle of deviation is formed between the original light ray and the refracted light ray. The size of the angle has a bearing on the refractive index. Their formula for their relationship is;

$$e'_x = \int_{z_1}^{z_2} \frac{1}{n} \cdot \frac{\partial n}{\partial x} dz$$

$$e'_y = \int_{z_1}^{z_2} \frac{1}{n} \cdot \frac{\partial n}{\partial y} dz$$

In the formula,  $E$  is the refractive angle,  $n$  is the refractive index of the medium, and  $z$  is the original uninterrupted direction of the light ray.

If we take  $n(\text{zero})$  as the refractive index of the air medium around the interfering area, and  $n$  as the medium refractive index inside the interfering area, then we can rewrite the above formula as follows:

$$e_x = \frac{L}{n_0} \cdot \frac{\partial n}{\partial x}$$

$$e_y = \frac{L}{n_0} \cdot \frac{\partial n}{\partial y}$$

According to this, we can design a group of layer-like light ray pictures. According to the above formula, we can get a light route picture with light reflection equipment shown below.

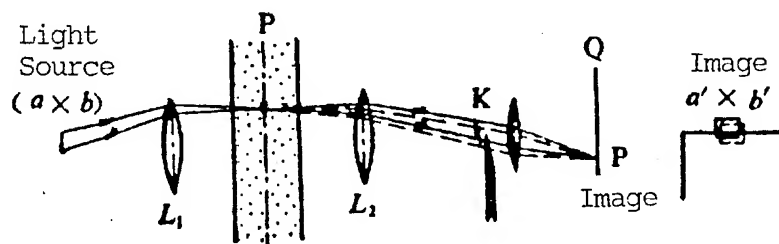


Figure 1 Imaging Equipment Illustration

The deviation of the original light causes a relative position shift of the illuminated picture at the focal plane,  $K$ . At this point, if we use a knife to block part of the light at  $K$ , then the illumination on the screen  $Q$  changes. Thus, we can give a picture image  $P$  on the screen.

## II. Experimental Distribution

All light reflection equipment used was of the 640-A type. The optical system is shown in Figure 2. The light source from  $S$  became parallel light rays after passing through reflecting mirror  $M_1$ , which then passed through the testing area  $L$  and was projected on another reflecting mirror  $M_2$ . The reflected light rays focused on the edge of a knife  $K$ . They were then video taped.

The hand of a Qigong master was placed in the test area. While he was emitting external Qi, the process was recorded by a video camera. The beam passing bore of the equipment was 292 mm. Focal distance of the lens was 3m. Sensitivity of the equipment was 1/100 (illumination change). Sensitivity of the refractive deviation angle was  $0.7 \times 10^{-6}$  rad.

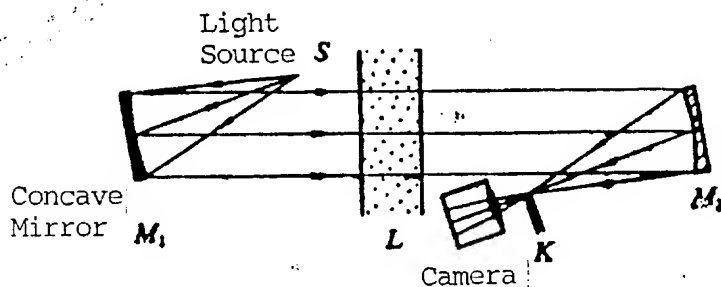


Figure 2. 640-A light image equipment system

### III. Results and Discussion

Typical visualization of an external Qi field from a Qigong master is shown in Figures 1 - 5. From these Figures, we see clearly that the external Qi emitted by the Qigong master grows from nothing (weak to strong). At first, there was only a small disturbance in the medium field around the finger tip (shown in Figure 1), then the disturbance of the external Qi spread out forward (see Figures 2 and 3) until the climax of the emission (Figures 4 and 5). The external Qi then stopped. It was found from this experiment that the lengths of time needed to emit external Qi from each Qigong master differed. For some Qigong masters, it lasted only one to two minutes. Some Qigong masters however, could continuously emit external Qi for long periods. It can be seen from the images taken that while external Qi was disturbing the air medium around it, it appeared as billowing smoke from a chimney, which formed an air flow affect on the patient's body.

For comparison, a grain image picture of a normal person's palm is shown in Figure 6. Even though the density of the medium field around the fingers showed some changes, there was no directional movement and the value was small.

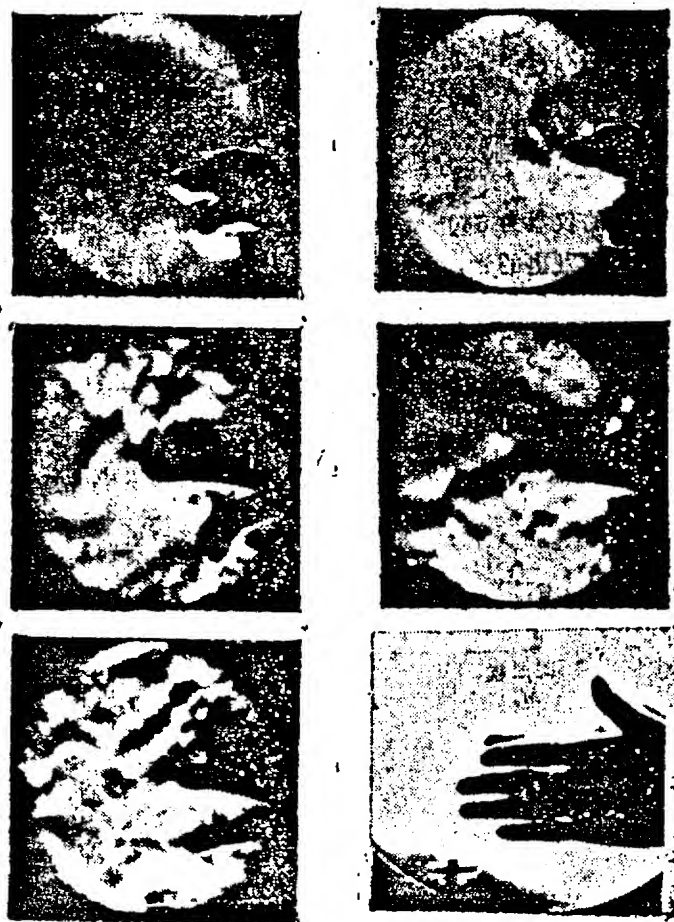


Figure 3 Experiment photographs

In conclusion:

1. An external Qi field can be illustrated by using the optical method to visualize the hydro-dynamic information in the external Qi field. The results of the process of Qigong emissions by Qigong masters can be recorded by video cameras.
2. The results of visualization clearly show the existence of an external Qi field. It can affect the density of the surrounding air medium field.
3. Not all external Qi information emitted by Qigong masters observed was recordable. Even though some Qigong masters can emit external Qi, there were no obvious difference between the grain image figures of the hands of these Qigong masters and ordinary hands.

This tells us that there are different types of external Qi from different Qigong masters. This may be one of the reasons why different Qigong masters can cure different types of diseases.

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## Research on Electromagnetic Wave Radiation of the Human Body

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### Summary

Our analysis shows that electromagnetic waves from the body can be produced using forceps to touch a small piece of metal. The frequency band of the electromagnetic waves ranges from 0.1 MHZ to 300 MHZ when measured by a high frequency multi-voltmeter with a voltage input of  $10^{-8}$  to  $10^{-7}$  V. The frequency cycle seems complicated at the lower frequencies.

### I. Introduction

The phenomenon of electromagnetic waves emitted by humans has been reported previously. In the 1960's, it was reported at the Radio Technician's Conference that humans can emit radio waves at a frequency of 150 KHz. It was presumed that higher frequency radio waves can be emitted by humans. In the 1980's, the intensity of some radio waves from a small distance or on the surface of the human body was recorded in experiments conducted by the Russian Science Academy.<sup>1</sup> An American scientist also found that cells emit weak electric waves. On the other hand, radio waves can be felt by humans. In an experiment done in 1960, a vibrator with only an energy flow of a few milliwatts was used a few feet away from the person being tested to emit electromagnetic waves ranging from 300 to 600 KHz. The person being tested could feel his brain pulsating, his ears ringing and agitation when the electromagnetic waves were between 380 to 500 KHz.

There have been cases observed where people could hear the pulse signals from radio microwaves. There also was a case where a person interfered with pictures on a television screen while emitting Qigong.

Electromagnetic waves are produced when the speed of electric charge movements change. Sodium and other metal ions exist in human blood. Formation of organisms is asymmetrical and absorbencies differ. Therefore, it is not unusual that human bodies emit electromagnetic waves. The problem is that these electromagnetic waves are so weak that they have to be increased  $10^8$  times to be felt. (See footnote 1).

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1. Psi was studied by Russians with physical and chemical-methods, May 25, 1987, Reference News.

What is the frequency band's weight of electromagnetic waves from a human body? What is the intensity of these waves? What is the frequency cycle? These are the basic questions that need to be answered when we study electromagnetic waves emitted from the body. Since we have found a new phenomenon that affects all these questions, we tried to obtain data regularly with complete wave band radio equipment.

## II. The Discovery of a Transmitter

In July of 1987, while we were testing the property of a piece of metal piece, we found that there were electromagnetic waves emitted when a hand was holding forceps poking the metal piece. This is a new phenomenon that has never been reported. In order to find out the reasons, we have done a series of elimination experiments. In the first experiment, our question was whether it was caused by the content of different metals due to the contacting potential between two different metals. We have done experiments on copper, steel, and other types of metal. There have always been electromagnetic waves found. So, we eliminated the possibility that it was caused by the content of different kinds of metals. Our second experiment was to find out whether electro-magnetic waves emit from the hands. We tried to keep the degree of insulation between the hand and the metal piece high enough to be dependable. For instance, using the top of an electric pen over 1000 V so as to keep good insulation between the hand and the metal. Then we poked the metal piece with the pen and found no electro-magnetic waves. On the other hand, when poking the metal piece with the hand holding the metal part of the electric pen, electro-magnetic waves were emitted. We also found that there were no electro-magnetic waves found when the forceps fell freely from a short distance. This indicates that the phenomenon of electro-magnetic waves with the hand. The third question was: Why is associated with the hand? The body is a conductor, so the hand functions as an antenna. Would the electro-magnetic waves result from contact with electro radio waves by holding forceps in one's hand?

We did some experiments in various shielded rooms. Still, electro-magnetic waves were found. We were able to measure the wave length of the wave bands in the shielded rooms. This also indicates that electro-magnetic waves were produced by the bands. Our fourth question: What is the electric potential transmitted by the hand? There is electric static low frequency potential and high frequency, vibrating potential in a human body. The first two potentials should be in a pulsating current to produce electro-magnetic waves. Thus, our question changed to whether the electro-magnetic waves produced by the metal slice were affected by the three electric potentials jointly or primarily by one. To test the electrostatic potential, we connected metal slices with two heads of a milli-voltmeter, then used



one hand to hold on of the metal slices tightly, and the other hand to hold the tweezers and hit the other metal slice suddenly. Thus a simple series connection was formed. A current ranging from 0.1 UA to 5 UA could be seen passing through the body. As the tweezers hit the metal slice, we observed the current increase from weak to strong. As the tweezers left the metal, the current suddenly reduced to zero. There were no electro-magnetic waves found. Therefore, we saw that the amount of the electro-magnetic waves in the pulsating current produced by electrostatic potential in the body was very small. The most reasonable assumption is that the high frequency vibrating potential should be considered the main electric potential causing electro-magnetic waves. That is to say, the hand, the tweezer and the metal slices formed a transmission system for human electro-magnetic waves. Regular full range radio equipment should be used to study extremely weak human electro-magnetic waves.

### III. Experiments and Results

Equipment: A DW3 type, very high frequency milli-voltmeter with a sensitivity of 0.5 MHz - 300 MHz made by the Beijing No. 2 Radio Equipment Factory which is actually a highly sensitive superheterodyne radio set; an electric light sensor with a sensitivity of over 70 db made by the Chenjiain company with its frequency ranges from about 100 KHz to the television channel band; an enamel insulated wired coil with 150 coils and an average diameter of 12 cm; a 13cm x 3.3cm x 0.03cm copper slice; an 18cm x 5.2cm x 0.2cm aluminum slice; tweezers, and a rectangular piece of granite as a spacer for the metal slices.

In the experiment one end of the coil was connected to the probe of the milli-voltmeter. The coil was placed vertically. The metal slice was put on the granite piece horizontally alongside the coil with one end passing slightly through the center of the coil. Otherwise one may put the metal piece about 2mm under the metal needle of the milli-voltmeter probe without the coil, which is similar to a ring antenna and a whip like antenna. The electric light detector was used only to examine the existence of electro-magnetic waves from the metal piece. In order to minimize the effects of the human body on the equipment, the distance between the body and hand to the equipment and the position of the hand holding the tweezers, the location, strength and the speed of impact on the metal piece were kept unchanged as much as possible.

Maximum sway was taken as the standard recording. The starting and ending positions of the needle measure the frequency. The difference of two readings of the needle was the input voltage measured. An average value was taken after each frequency was measured five times.

Three people were tested for comparison: A seventy-five year old female, a seventy-one year old male, and a thirty-five year old male. The health of the first two were good and the latter was strong. None of them had practiced Qigong.

The experiment was done in three parts. The first part took place in their own homes without shielding. The second part was done in a shielded room. In these two parts of the experiment, electro-magnetic waves were received by the coil. The third part was done in an unshielded house. Electro-magnetic waves were received by the metal needle on the probe of the milli-voltmeter. The following is a summary of the experiments with frequencies below 500 KHz and without radio transmission.

Experiment 1. Location: A house. Time: Morning, afternoon, and early morning.

Cars passed by the house causing large sways beyond the capacity of the milli-voltmeter needle. When all the readings were connected with an unbroken line, it was considered an envelope. The intensity of the electromagnetic wave field measured was strong. The maximum input voltage was 10uV, minimum voltage was 1uV and average voltage was 4uV.

Experiment 2. Location: A shielded room in the Beijing Radio Factory. Time: Noon.

The room was built with two layers of copper nets. Medium wave transmissions could not be received. The shielded condition was incomplete because the incoming wire was not wave filtered. The room was not disturbed by passing cars or radio stations. The intensity of the electro-magnetic field was about 1/20 of that in experiment 1. The maximum intensity measured was 0.3uV, the minimum about 0.1uV, and average about 0.2uV.

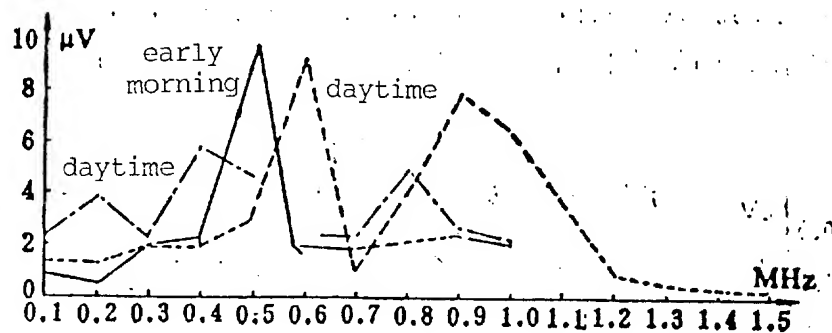


Figure 1. Experiment curves in the unshielded room from the seventy one year old male subject.

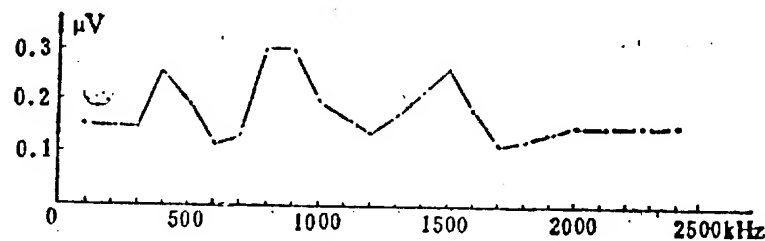


Figure 2. Experiment curves from the seventy-one year old male in an incompletely shielded room.

Experiment 3. Location: A shielded room at the University of Beijing Medical School. Time: Morning. Some high frequency radio stations could be received due to the incompletely shielded condition. The experiment was slightly disturbed by some radio frequencies. The following two figures have similar reading values to those in Experiment 2. The intensities of the electro-magnetic fields varied between different subjects. Two subjects had similar frequency spectrums and two subjects had the same average value of 0.15uV.

Experiment 4. Location: A shielded room in Department 5 at Beijing University of Science and Engineering. Time: Morning.

The shielded condition of the room was up to specifications. The incoming wire was wave filtered. The copper nets were connected to the ground. The medium and short waves were completely shielded. The results of experiment 4 are shown in Figure 4. The two bottom curves that are nearly identical are from the same subject.

The lowest curve has the weakest intensity value among all the experiments with its maximum value being 0.17uV and minimum value 0.04uV. Most of the curves were below 0.1uV with an average value of 0.08uV which was only 1/5 that of experiment 1.

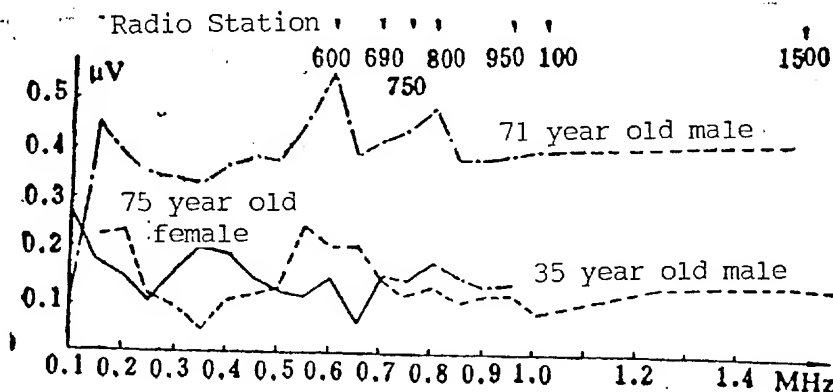


Figure 3. Experimental curves (2) from three subjects in the incompletely shielded room.

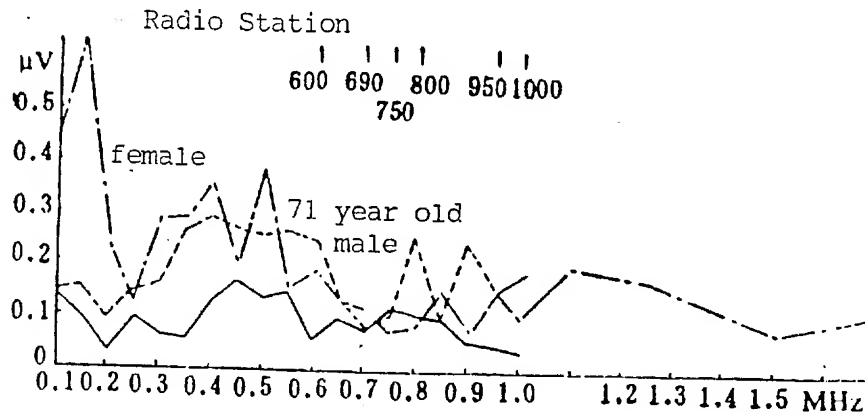


Figure 4. Experimental curves from two subjects in the completely shielded room.

Experiment 5. Location: Ordinary house. Time: Evening and late night.

Electro-magnetic waves were received by the short indicating needle on the probe of the milli-voltmeter. No shielding was given since the extreme of the emission source was very close to the short indicating needle. It was not disturbed by radio stations except some broadcasting in high frequencies. The reading of the needle was very stable and dependable. The results of this experiment (shown in Figure 5) were similar to that of experiments 2, 3, and 4, where electro-magnetic waves were received by the coil in shielded rooms.

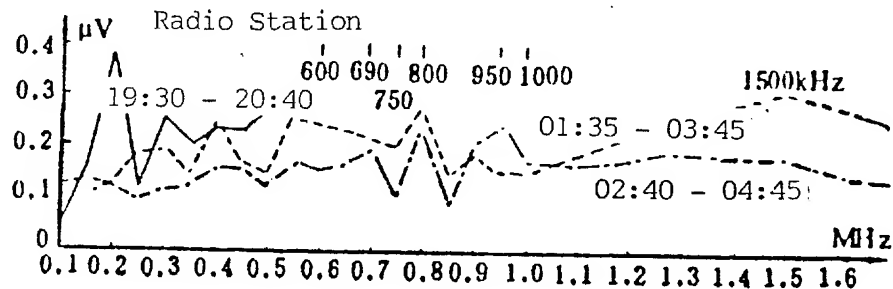


Figure 5. Experimental curves from an unshielded room where electro-magnetic waves were received by the metal needle.

#### IV. Conclusions

We have done more than thirty experiments in which some responses could always be found by the milli-voltmeter with frequencies ranging from 0.1 MHz to 300 MHz. After the frequency was higher than 1MHz, most of the intensity values were below 0.1uV. There were no big changes. When the frequency was lower than 1 MHz however, the formation of frequency spectrums seemed to be complicated. The shapes of the curves from each experiment were similar to those in

Figure 6. To show the frequency spectrum of the electromagnetic waves from the body under a well shielded condition, we show individually the lowest curve from Figure 4 in Figure 7.<sup>2</sup> This connects the experimental phenomenon mentioned in our introduction that seemed irrelevant. It also answers the three basic questions.

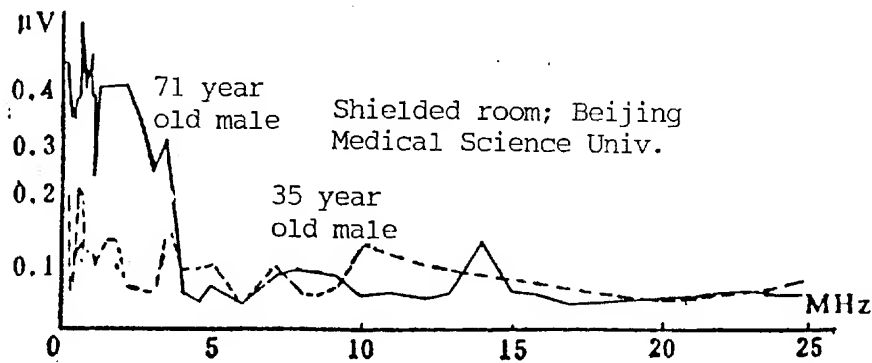


Figure 6 Frequency spectrum of human electromagnetic waves within 25 MHz

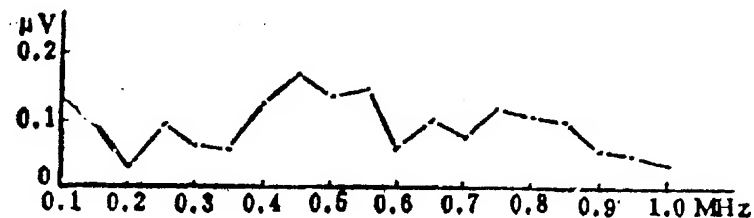


Figure 7 Frequency spectrum of human electromagnetic waves within 1 MHz

The intensity of electro-magnetic waves ranged from  $10^{-8}$  to  $10^{-7}$ . (See Footnote 2). Frequency periods from a person are not unchangeable. Frequency spectrums differ between people but the differences due to age and sex are minor.

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2. A metal cavity or cage can only shield static electric fields or slowly hang electric fields. The higher the frequency of a vibrating electric field, the worse the shielding effect. Therefore, a completely shielded condition is impossible. In the shielded room of Department 5 at Beijing University of Science and Engineering, there was no medium or short wave radio transmissions received by the millivoltmeter. The results are discussed under this relative condition.

The explanation for the experiment mentioned in our introduction in which a person was irradiated by electro-magnetic waves and had varied responses could be that electro-magnetic resonances are produced by the human body between the frequency band of 380 KHz to 500 KHz. If this is true, electro-magnetic pollution should be highest in this frequency band.

Using a short metal needle may be a simple and feasible method to receive electro-magnetic waves from the body. The intensity measured in an unshielded condition was 50 times higher than that measured under shielded conditions when the coil was used in the experiments. This can be understood as worldwide radio waves being the "background" for the energy of electro-magnetic waves. Added on it were the electro-magnetic waves from the human body itself and the strong electromagnetic waves from radio stations. Therefore, it is possible to obtain similar results from experiments of electro-magnetic wave radiation from humans under either unshielded or incompletely shielded conditions.

We greatly appreciate the valuable suggestions of Mr. Zhu Boshen.

#### V. Postscript

After finishing this article, we invited Professor Xie Huanzhang to emit Qigong. In the first test he emitted Qigong three times with his hand from two or three meters measured by the antenna of the sensitizer made by the Chen Company. The sensitizer produced sound twice. That is to say, it received electro-magnetic waves. In the second test, he tried five times. Only one time were electro-magnetic waves received. He also used tweezers to poke a metal piece producing electro-magnetic waves as measured by the sensitizer. If compared with electro-magnetic waves produced by the cracking of crystal sugar, the intensity of his electro-magnetic wave field was estimated to be greater than 10m v/m at a distance of 10cm.

We also invited Qigong master Chang Weidong for a test for experiment 5. When Qigong was emitted, the highest intensity of his electro-magnetic waves was 300 KHz to 400 KHz, which was greater than 1uV. Energy was much greater than when Qigong was not emitted.

From the above phenomenon, we concludes that electro-magnetic waves can be produced when Qigong is emitted. However, more research and study needs to be done to answer the question of what the relationship is between Qigong and electro-magnetic radiation. We hope that our research can be helpful in further studies.

pathetic nervous system seemed to be in a state of relative hyper-function after Qigong practice which lasted a certain period of time after stopping Qigong practice, so thus the subjects' heart rates remained higher. Also, we found that most of the subjects' secreted saliva increased and their bodies or hands felt warm and sweaty while they practiced Qigong, which probably resulted from Qigong causing the sympathetic and para-sympathetic nervous systems to be in a state of hyper-function.

In summary, our conclusions are: Qigong is likely to help recovery from stress and is also likely to keep the sympathetic nervous system in a relative state of hyper-function.

## Experimental Research on the Infrasonic Information of Qigong and Exceptional Functions

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### Introduction

The history of Qigong and exceptional characteristics can be traced back a few thousand years, Qigong part of the cultural heritage of our country. It has been extensively applied to preventing and curing disease as well as exercise for body and mind. Beneficial results have been obtained, however there has been very little understanding and very few studies have been done for verification. For instance, there are many problems which need to be studied and resolved such as the form Qigong takes in the human body. Is it caused by a single factor, or a combination of many factors? How is it produced? How does it travel? How is it collected? How does it accumulate? How is it emitted? How does it disappear? What is the substance that carries Qigong? Is there a channel that carries it? What are the biological and physical effects? Is Qigong related to the space outside a human body? Only if we know its existing mechanism well can we bring its effects into full play.

Since the 1970's, Qigong has caught people's attention at home as well as abroad. Scientists from Europe, the United States, and Japan have paid much attention to it and have been actively studying it. It is reported that Japan has established a research institute for Qigong studies. Qigong has also been studied extensively and used for military purposes in the United States and the Soviet Union.

In recent years, Qigong and exceptional characteristics have been studied as a special subject in our country. It has been included in the study of anatomy.

Many scientists have done experiments on so-called external Qi emitted by Qigong masters and people who have exceptional characteristics. For instance, the study of radio electromagnetic waves, infrared ray electro-magnetic waves, static electric effects, magnetic field messages, micro-partical flow information and infrasonic signals, etc. The results of these studies have proven the substantial properties and the objective existence of "external Qi."

There were ten Qigong practitioners and exceptional Psi people as well as ten non Qigong practitioners taking part in our study. Qigong was measured by infrasonic testing devices from various distances through many different acupoints without contacting the microphone varying levels of controlled thought.



To further confirm the substantial properties of Qigong information, our aim includes observing and studying the responses of the body's infrasonic information with or without Qigong, from different distances and conditions. This may provide a scientific basis for further studies of the biological and physical effects of Qigong as well as make use of the potential energy of the human body.

### I. Method

1. Testing and analysis equipment: A set of infrasonic testing devices made by the Damark B-K Company including a 2209 type precise pulse counter, a 5742 low-pass wave filter, a 1616 1/3 times frequency cycle wave filter, a 4166 type electric capacity microphone and a 7003 magnetic recorder. The low-pass wave filter was a special attachment of the infrasonic testing devices, its frequency ranging from 2 Hz to 20 Hz. The signals measured were analyzed by a Japanese made CF-500 two-way signal analyzer.

2. Testing conditions: The test was conducted in a sound proof room with a background noise of 40 dB. The microphone was fixed on an adjustable stand in the room facing down vertically with a small distance from the body surface (non-contacting test). Researchers stayed outside the sound proof room while testing and recording. The subjects sat in the room near the microphones with masks on to avoid disturbing the airflow. The subjects acupoints tested included Laogong, Zhijian, Baihui, and Mingmen. The Laogong point was tested from a distance of 1, 3, 5, and 10 cm away from the center of the palm. In the Zhijian point test, five fingers were required to be joined together. The microphone was 3 cm away from the Zhijian point. In the Baihui point test the microphone was 3 cm away from the top of the head. In the Mingmen test, the microphone was 6 cm away from the surface of the Mingmen area. Besides these tests, controlled thought tests were conducted without the microphone pointed at any points. During the test, the Qigong was in a quiescent situation. The microphone was 40 cm away from the center of the subject's body without pointing toward any points. There were altogether four points and six distances tested.

There are three states of thought in the testing of infrasonic information from the body. They are: (1) Thought directed at the point at the time of the test (thought concentration on acupoints). (2) Thought directed on a point other than that being tested. For example, thought on the Yongghan point while the Laogong point was tested (diverting of thoughts). (3) Thought concentration inward (actual state of thought).

3. Testing time and requirements. In order to obtain accurate data and signals, the test was conducted between 12

and 3 o'clock in the morning when there were the fewest disturbances from outside. The subjects were required to sit naturally, relax and be comfortable with eyes closed.

## II. The Results

In our test, the subjects were divided into two groups: A Qigong group (including Qigong masters and people with Psi), and a non Qigong group (the comparison group). There were ten people in the Qigong group who had good knowledge and skill of Qigong. Among them were seven males and three females, their ages ranging from 28 to 61.

The non Qigong group included four males and six females who had never practiced Qigong. Their ages range from 17 to 41. All the requirements of these two groups were the same except that the emission process of Qigong was not required in the non Qigong group.

When preventing and curing disease, most Qigong masters and people with Psi use their hands, we emphasize testing the infrasonic sound pressure level and its peak value frequencies from the Laogong points.

1. The infrasonic responses from the Laogong points tested are shown in Table 1.

The Laogong point test was conducted from four different distances with the concentration on the acupoints. It was shown in the results that the sound pressure level of the infrasonics of the Qigong group were obviously higher than the comparison group. This indicates that thoughts play a very important role in Qigong. It was also found that there were no obvious differences in the responses of infrasonic sound pressure levels from different distances, which indicates that distance is not an important factor.

Table 1  
Average Values (dB) of the Responses of Laogong Point Infrasonic Sound Pressure Levels

State	Distance		Qigong Group	t	p
	(cm)	Comparison Group			
Concentration on Laogong Laogong tested	1	42.4±1.90	49.6±2.50	6.2388	≤0.001
	3	41.3±1.25	50.4±3.10	7.2311	≤0.001
	5	40.7±0.48	48.8±2.27	9.1316	≤0.001
	10	40.6±0.53	50.6±3.28	7.9049	≤0.001

The infrasonic sound pressure level peak value frequency is very important in the study of Qigong's mechanism and its application. Therefore, we analyzed infrasonic sound pressure peak value frequencies from Laogong points. (See Table 2.)

Table 2  
Responses of Peak Value (H2) Frequencies of the Infrasonic Sound Pressure Levels

state	Distance (cm)	Comparison Group	Qigong Group	t	p
Concentration on Laogong Laogong test	1	5.85±4.56	4.47±1.79	0.8334	>0.05
Laogong test	3	4.31±2.74	5.14±2.49	0.5919	>0.05
Laogong test	5	3.96±2.69	5.07±2.44	0.8568	>0.05
Laogong test	10	2.99±0.55	4.33±1.67	2.0119	>0.05

It is shown in the table that there are no obvious differences in the average peak value frequencies of the infrasonic sound pressure levels between the two groups. The peak value frequencies ranged between 3Hz and 5 Hz. Only on a few points from some subjects did the peak value frequencies appear in the range of 10 Hz to 12.5 Hz.

2. Zhijian point tests were conducted with the thoughts concentrated on these points. The results of the average values of the infrasonic sound pressure levels are shown in Table 3.

Table 3  
Responses of Average Values (dB) of Infrasonic Sound Pressure Levels from Zhijian Points.

State	Distance (cm)	Comparison Group	Qigong Group	t	p
Concentration on Zhijian Zhijian Test	3	43.1±0.99	48.0±1.41	7.7472	<0.001

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The infrasonic sound pressure levels from the Qigong group were still obviously higher than the non-Qigong group. It also indicated that thoughts played a leading role in Qigong.

3. Infrasonic information from other points. This means tests of Baihui and Mingmen points without thoughts concentrated on these points. Results are shown in Table 4.

Table 4  
Average Values (dB) of Infrasonic Sound Pressure Levels from Other Points.

State	Distance (cm)	Comparison Group	Qigong Group	<i>t</i>	<i>p</i>
Concentration on Baihui Baihui Test	3	42.8±0.83	51.3±4.15	4.4463	<0.01
Concentration on Mingmen Mingmen Test	6	43.6±0.54	54.7±5.79	4.2167	<0.01
No concentration on Accupoints	40	42.8±0.83	47.6±2.77	3.7286	<0.01

It is shown in the table that from two points and two states of thought, infrasonic sound pressure levels from the Qigong group were obviously higher than the comparison group. In the test where thoughts were concentrated on any points, infrasonic information energy from the surface of the body reduced noticeably. This indicates that infrasonic information can be transmitted through space.

4. Comparison of infrasonic sound pressure levels from two states of Qigong thought. (See Table 5.)

Table 5  
Comparison of Infrasonic Sound Pressure Levels (dB) from Two States of Qigong Thought.

Concentration on Laogong Laogong Test	Concentration on Yongquan Laogong test	<i>t</i>	<i>p</i>
52.43±2.76	48.85±2.26	2.6450	<0.05

In the Laogong test as shown in Table 5, infrasonic sound pressure levels were obviously higher when thoughts were concentrated on points than when thoughts were diverted. Infrasonic sound pressure levels measured from different points of body were mostly between 50dB and 60 dB which was 10 to 100 times higher than the 40 dB background noise in the room.

Results of the infrasonic sound pressure levels as shown in the tables above clarified two points. (1) Conscious thinking activities of the brain in the state of Qigong (thoughts) undoubtedly play a leading role in adjusting, controlling and strengthening human infrasonic information energy. (2) An objective basis for the theory that "Qi comes as thought comes" in Qigong therapy was provided.

### III. Discussions

By testing and analyzing infrasonic information from a few points of the human body, we substantiated the following two points.

1. Substantial properties of infrasonic information, its transmission, and the existence of its field are found in the body. Even though its substantial property had been proven by many scientists through tests, there are still dissenters. As to the problem of transmitting forms of external Qi, its biological and physical effects still need study. Many people still consider Qigong and Psi as mysterious, incredible and even pseudo-science mentioned in the same breath as witch doctors and magicians. With special infrasonic testing devices, infrasonic information and its energy from the surface of the body has been clearly measured by the microphone non-contact method of our study. Results of this study undoubtedly confirmed that human infrasonic information (one of the components of internal or external Qi) is objective and substantial. There have been many studies discussing propagation of information inside the body (internal Qi). There have not been many studies on the propagation and movement of external information (external Qi). By testing from different distances, our study proved that infrasonic information is movable. It can propagate (spread) through space and air mediums. There were no obvious differences found in the responses of infrasonic sound pressure levels from the distances tested in our study, which is consistent with the physical property of sound waves.

A few articles [2,5,6] have been published concerning "biological fields," "biological electric fields," "biological plasma fields," "human body energy fields," and "morphological fields." This research proves the existence of "fields" outside the body. In our study, data was measured without an obvious decrease even at further dis-

tances. This indicates clearly that there are actual "fields" existing around both human and animal bodies.

2. Infrasonic information is the objective manifestation of life. It is thought by Qigong researchers that so-called "external Qi" is from "internal Qi," emitted by Qigong masters or people with Psi. It is also thought by some that the "Qi" from Qigong, the vitality of the body, is the "life information" of man. Whether everybody has it thus became the question needing to an answer. We agree with the phrase "life information," because there is a close relationship between life information and life itself. If there is life information exists. Therefore, not only humans but all living animals have this information. Our study also indicates that not only Qigong masters or people with Psi had infrasonic information but those who do not practice Qigong have it as well, which explains whether "it comes from everyone." It is shown in our study that there were obvious differences in the natural wave shapes of infrasonic information between Qigong masters as they were emitting Qigong and the non-Qigong group. Natural wave shapes of infrasonic information from Qigong practitioners appeared to be shuttle-like. Amplitudes of natural wave shapes were relatively higher than those of the non-Qigong group, which had small, continuously smooth waves with lower amplitudes. (See Tables 1 to 7).

Professor Qianzueshen once pointed out that there is a close relationship between Qigong and Psi. It is also felt by some that when people practice Qigong to certain extent, they have similar functions as those with Psi. That is to say, they acquire remote sensing and visualization abilities, perspective sight, x-ray vision and foreseeing ability. From the information wave shapes shown above, we see that the wave shapes of Qigong masters are similar to those with Psi. Their waves appear to be shuttle-like with high amplitudes, which may be the basis for changing Qigong to Psi.

Besides the previous study, we also tested infrasonic information from both dead and living rabbits. It was found that animals as well as have infrasonic information on their body surfaces with wave shapes similar to those of the non-Qigong group (see Figure 8). Infrasonic information of life information, which exist everywhere, is different from infrasonic information the state of Qigong. It is likely that all living animals (including humans) have this kind of infrasonic information, the objective indication (expression) of life.

MI: 5 20 I 1 MI: 1  
MII: 5V 20Hz I 1/2 MII: 1

MI N  
MII 1/3

HI-A 7.012s 0.05V  
LO-A 7.812s 0.036V

Approved For Release 2000/08/10 : CIA-RDP96-00792R000200270001-6

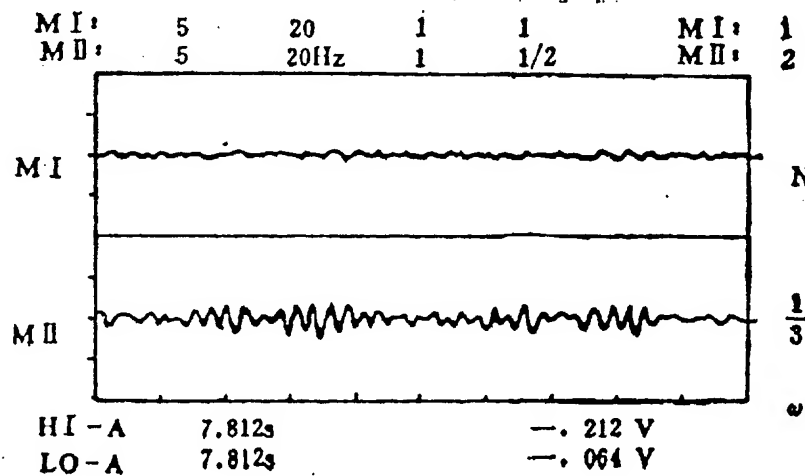


Figure 3. Top line is infrasonic information from non-Qigong subject Wang's Laogong point. Bottom line is infrasonic information from Psi subjects Wen's Laogong point.

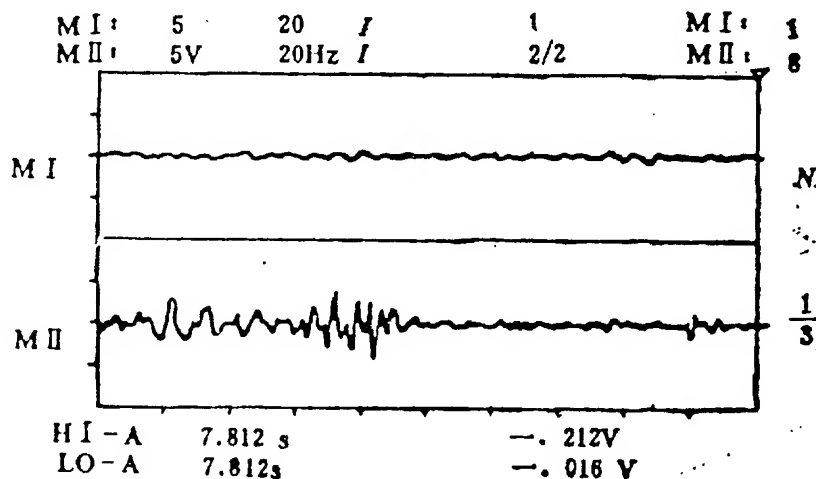


Figure 4. Top line is infrasonic information from non-Qigong subject Wang's Laogong point. Bottom line is infrasonic information from Psi subject Chang's Laogong point.



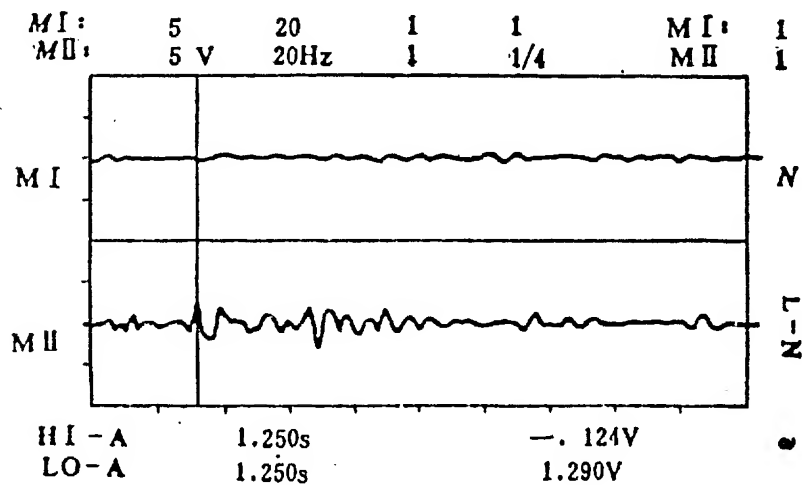


Figure 5. Top line is infrasonic information from non-Qigong subject Chang's Mingmen point. Bottom line is infrasonic information from Qigong master Wei's Mingmen point.

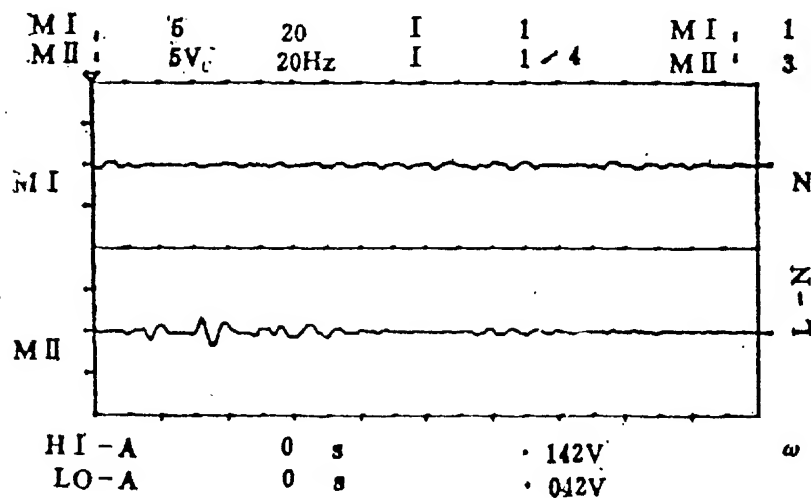


Figure 6. Top line is infrasonic information form non-Qigong subject Chang's Baihui point. Bottom line is infrasonic information from Qigong master Wei's Baihui Point.

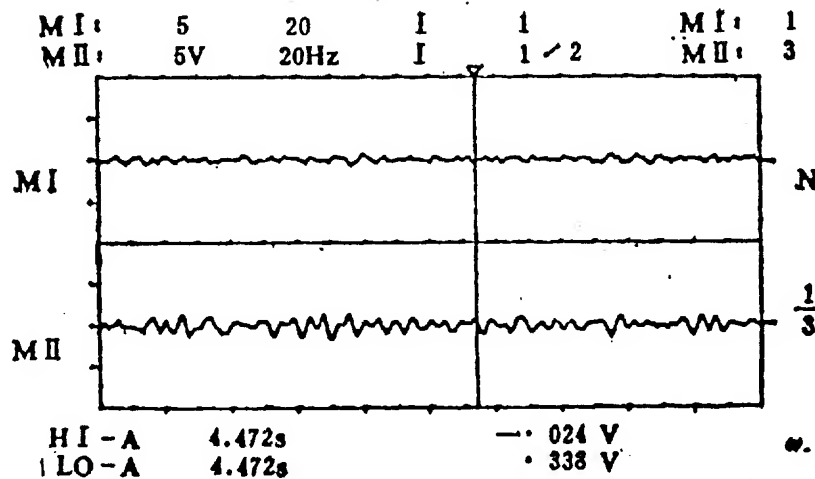


Figure 7. Top line is infrasonic information from non-Qigong subject Wang when not concentrating on any points. Bottom line is infrasonic information from Qigong master Meng when not concentrating on any points.

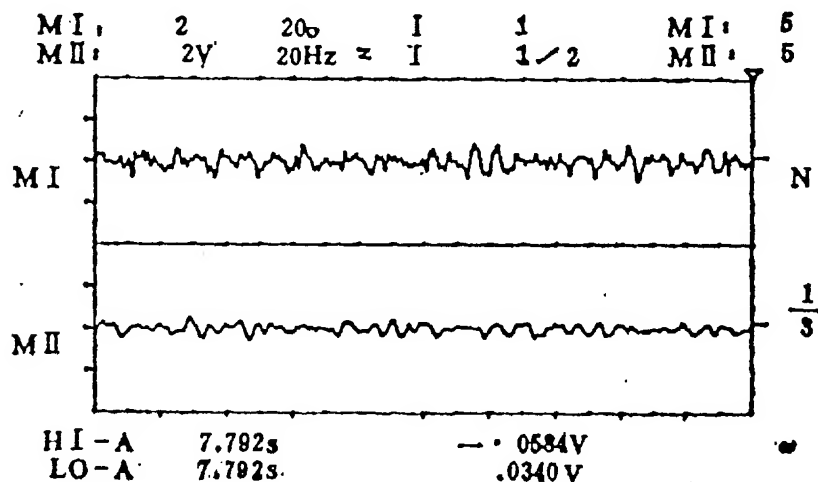


Figure 8. Top line is infrasonic information from the top of a live rabbit's head. Bottom line is infrasonic information from the top of the same rabbit's head in death.

#### IV. Discussions

1. Infrasonic sound pressure levels from all points tested were obviously higher (50 dB to 60 dB) when Qigong was emitted, (from 10 to 100 times that of the background noise). The peak frequency value of human infrasonic sound pressure levels were between 3 Hz and 5 Hz with a few values ranging from 10 Hz to 12.5 Hz from certain points.
2. Infrasonic information from the surface of the body, has substantial properties, objectively exists, and can travel through space.
3. There is a close relationship between infrasonic information in the body and life. Infrasonic information appears at the beginning of life and disappears as life ceases. This kind of infrasonic information occurs in humans as well as animals.
4. The amount of infrasonic information is obviously higher when thoughts are concentrated on a point than when thoughts divert. This is objective proof of the important role played by thoughts and the fact that "Qi comes as thought comes" in Qigong practice.
5. The existence of "fields" around the body is a reality.

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## Effects of Qigong on Excretion Amount of Urinary Catecholamines.

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It is felt that Qigong can decrease stress and cure some diseases of the body and mind. There is a close relationship between the sympathetic adrenalin gland medullary system and stress response. We assume that Qigong may have something to do with the functions of the sympathetic adrenalin gland medullary system. The amount of catecholamines in urine tested may reflect the functions of the sympathetic adrenalin gland medullary system. This experiment studies the effects of Qigong on urinary catecholamines and probes the mechanism of Qigong effects.

### I. Method

Subjects: 111 people were tested in our study who have practiced different kinds of Qigong. Among them were 59 males and 52 females. The average age was 52. The youngest was 22 and the oldest was 78.

Collection of urine samples: Samples were collected twice. After practicing Qigong, the subjects were required to empty their bladders and obtain the samples after an hour of Qigong practice. The second time, for comparison, urine samples were collected without Qigong practice at the same time but at different dates.

During this experiment, the subjects were also required to empty their bladders. The comparative positions and amount of exercise were decided according to Qigong positions and amount of exercise of each different type of Qigong practice. For instance, there is relatively larger amounts of exercise in Dayian gong, so subjects were led to do setting up exercises to music three times. The remaining time they were either standing or taking a walk. For Yiangqigong and Chanmigong subjects, the setting-up exercise was done only once either standing or taking a walk the rest of the time. The Zhanzhuanggong and Laozi Quanzhengong subjects were only required to stand. Zhenqi Yunxienggong subjects were only required to sit in the comparison experiment. Urine samples were also collected an hour after the comparison experiment without Qigong. Content of the urinary adrenaline and noradrenaline were determined by a fluorescent spectrophotometer.

## II. Results of the Experiment

1. Results of the adrenaline test are listed in Table 1. We see that there was an increase in the excreted amount of urinary adrenalin after Qigong practice. However, the increased values from most of the Qigong styles have not reached a remarkable level except from Dayiangong.

Table 1  
Change in Excretion Amounts (nmole/hr) of Adrenalin in Urine after Qigong Practice

Qigong Style	Number of Times Tested	Without Qigong	With Qigong
Dayiangong	19	$2.1 \pm 1.3$	$2.9 \pm 2.0^*$
Yiangqigong	34	$2.1 \pm 1.5$	$2.6 \pm 2.3$
Zhanmigong	10	$2.4 \pm 1.2$	$2.9 \pm 2.7$
Zhan zhuanggong	36	$1.6 \pm 1.0$	$2.0 \pm 1.4$
Laozi quanzhengong	7	$1.3 \pm 0.9$	$1.8 \pm 1.9$
Zhenqigong	6	$0.9 \pm 0.6$	$1.6 \pm 1.1$

t test comparison without Qigong.  $*p < 0.05$

2. See Table 2 for results of noradrenaline. From Table 2, we see that there was also an increase in the excreted amount of noradrenaline. Higher levels from Dayiangong and Laozi quanzhengong was remarkable. But for all other Qigong styles, amounts measured had not reached remarkable levels.

3. Length of time of Qigong practice and the excreted amount of urinary catecholamines. In order to see if there is a relationship between the length of time of Qigong practice and the excreted amount of urinary catecholamines, we grouped the subjects who practiced Yiang qigong and Zhanzhuanggong according to number of years of Qigong practice and analyzed the length of time from each group. Results are listed in Tables 3 and 4.

Table 2  
Change in Excretion Amounts (nmol/hr) of Noradrenalin in Urine after Qigong Practice

Qigong Style	Subjects Tested	Before Qigong Practice	After Qigong practice
Da Yiangong	19	$6.5 \pm 3.4$	$7.7 \pm 3.6^*$
Yiang Qigong	34	$7.4 \pm 3.6$	$8.3 \pm 3.3$
Chan Migong	10	$9.6 \pm 4.8$	$12.4 \pm 5.4$
ZhanZuanggong	36	$8.6 \pm 4.4$	$9.7 \pm 4.9$
Laozhi Quanzhengong	7	$7.0 \pm 1.8$	$11.2 \pm 3.2^*$
Zhen Qi Yunxigong	6	$6.8 \pm 2.0$	$8.1 \pm 2.3$

t test comparison with no Qigong practice,  $*p < 0.05$

time of Qigong practice for the 19 subjects was eleven months.

Among the 19 subjects in the Dajiangong group, the shortest period of time of Qigong practice was one year; the longest period was three years and three months; the average period of time was eleven months. The amount of urinary catecholamines excreted from the group after practicing Qigong also increased remarkably. This indicates that for those who have practiced Qigong for a long period of time and commanded better Qigong skills, urinary catecholamines excreted after practicing Qigong also increased obviously.

It is felt that the amount of catecholamines excreted during a good rest decreases. The excreted amount of catecholamines during sleep is low. Therefore, the results of our study indicate that practicing is not simply rest or relaxation, but a process of psychological activity on the mechanism of biological functions.

Catecholamines are not merely the nerve delivering substance of the sympathetic nerve system, but also a hormone secreted by the adrenalin gland medulla. The excreted amount of urinary catecholamines basically reflects the functions of the sympathetic adrenalin gland medullary system. The increase in the amount excreted indicates that the sympathetic adrenalin gland medullary system was in a relatively active state. Transcendental Meditation has similarities with Qigong. Lang found that people who practice Transcendental Meditation excreted higher amounts of catecholamines and VMA [1,3] in their urine. The noradrenaline element in their plasma increased remarkably. [1,3] Thus, they concluded that Transcendental Meditation activates the functions of the sympathetic nervous system. Results of their study have similarities with ours, however the main results of our study concern the increase in the excreted of the adrenalin not noradrenaline.

Research has been conducted indicating that under different situations, psychological activity can cause a change in the amount of catecholamines, usually by increasing the amount of the adrenalin. The increase however, was not obvious and has been unstable. It has also been found from research that the adrenalin excreted increased when an assignment needed to be done quickly and efficiently. Therefore, it is likely that the adrenalin plays an important role in doing work efficiently and keeping one's attention focused. It was also found from research that emotional activities increased. That is to say that when people are in states of excitement, happiness, nervousness, or horror, excretion of catecholamines increases. Qigong is usually practiced in an emotionally calm situation, which is differs completely from accomplishing an assignment with high efficiency and concentration. Then, what is the biological meaning (or significance) of the increased excretion of adrenalin under a

Qigong situation? This is a question which needs answering.

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## Effects of Qigong on Stress Responses

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Qigong has a history of more than a thousand years as a method of promoting health and curing diseases in our country. It is well known that Qigong can minimize stress and cure some diseases of the body and mind. So far however, there have not been any reports concerning the study of Qigong effects on stress response. Meditation is quite different from Qigong but has similarities. It has been found by some overseas researchers that the effects of meditation on stress response can not reduce stress response (compared with responses to skin electricity tests). It is more obvious that the rate of the heart increases under stress when a person is in meditation. Qigong is actually a process of adjusting the biological functions of mechanisms by psychological activities. The study of Qigong mechanisms can help explain ways of affecting biological functions by psychological factors. The study of effects of Qigong on stress response can not only help probe the biological mechanism of Qigong, but also help clarify the possible mechanism of Qigong in reducing stress response and curing body and mind diseases. This study explores the effects of Qigong on stress response.

### I. Experiment Methods

**Subjects:** There were 10 subjects in the experiment. Among them were four males and six females. Their average age was 44 with the youngest being 25 and the oldest 53. All had practiced Qigong for at least one year with the average time of their Qigong experience being one year and six months. There were also ten people in the comparison group which included the same number of males and females of the same ages and educational backgrounds as those in the experimental group.

Each subject was tested twice with each experiment divided into three periods. In the first hour, the subjects either practiced Qigong or rested. In the second hour they were given stress response tests. In the third hour rested. Five subjects from the experimental group practiced Qigong during the first hour of the first and second experiments. That is to say, those who practiced Qigong during the first hour in the first experiment rested during the first hour in the second experiment. Those who rested during the first hour in the first experiment practiced Qigong during the first hour in the second experiment. The subjects in the comparison group rested during the first hour of both experiments. All experiments were conducted from eight to ten o'clock in the morning.

Character color test: Four characters were written in red, green, yellow, and blue with four colors on each card. There were 40 characters altogether. The colors of the characters and the color of the cards varied. The subjects were required to do their best to write down the colors of the 40 characters on each card accurately in one minute as quickly as possible regardless of what characters they were. There were 15 cards altogether.

Mental Arithmetic Test: This test was divided into three periods with 75 math problems in each. In the first period non-regrouping subtraction problems were given. In the second and third periods subtraction problems that required regrouping were given. The subtraction problems were given using a phonograph at a speed of one problem per minute. The subjects were required to work mentally and write down the answers on paper. At the end of the test, subjects were asked to evaluate their state of nervousness as not nervous, a little nervous, nervous, or very nervous.

Steps of the experiment: Subjects entered the lab after a one hour rest or Qigong practice. They were asked to sit on the chairs and relax for 15 minutes. They were given the character-color test for 15 minutes. After a five minute break, they were given the mental arithmetic test for 15 minutes. They took another 10 minute break at the end of the experiment. RM-6000 multi-head psychological equipment was used to record the subjects pulse and breathing rates at the beginning to the end of the experiment.

Collection of urine and results: Subjects were required to empty their bladders and collect their first sample after a one hour rest or Qigong practice. The second urine sample was collected after the stress response test. The third urine sample was collected after a one hour rest. Urine samples were analyzed by an improved Von-Enler florescence spectro-photometer to determine amount of catecholamines.

## II. Results of the Experiment

In our experiment, subjects were in a state of stress due to the pressure of the character-color and mental arithmetic tests. Results of the psychological, biological, and biochemical responses, after accomplishing the intense assignments described above (before and after Qigong practice for the experimental group) and the comparison of the experimental group with the comparison group are described below.

Results of both groups from the first and second experiments were very similar. That is, there were no obvious differences. Results of the experiments were analyzed by the following method: Data from the experimental group were divided into two groups before and after practicing Qigong.

For the comparison group, results were analyzed according to their corresponding results in the experimental group before Qigong practice from the same experiment. There were five data groups in the first experiment from the comparison group and five data groups in the second experiment.

1. Heartbeat Rates: Results are shown in Figure 1. We see that there is an obvious increase in heartbeat rates when intense assignments were being done. There is a relationship between the increase of heartbeat rates and the difficulty of the assignment. Because the mental arithmetic tests were more difficult than test 1, heartbeat rates from tests 2 and 3 were higher than in test 1. It is seen from Figure 1 that heartbeat rates after practicing Qigong were higher than before practicing Qigong no matter whether in rest or intense working situations, which indicates that Qigong has an effect on heartbeat rates. Results of heartbeat rates from the experimental group before practicing Qigong and the comparison group were very similar. No obvious differences were found, which indicates that there was no relationship in the state of stress response between the heartbeat rate of inactivity and when practicing Qigong.

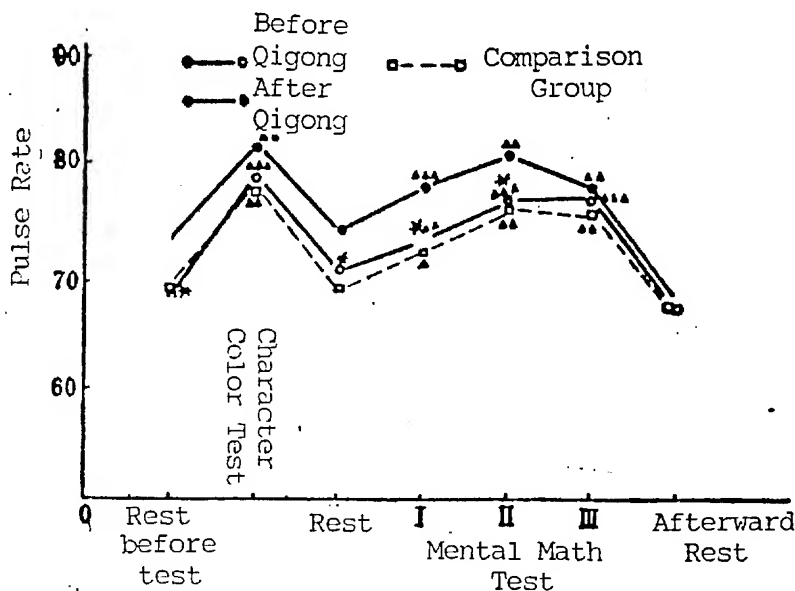


Figure 1. Pulse rate variances in state of stress.

Comparison with the first rest,  $\Delta p < 0.05$ ,  $\Delta \Delta p < 0.01$ ,  $\Delta \Delta \Delta p < 0.001$  comparison with non-Qigong practice \* $p < 0.05$ .

2. Respiratory Rates: Figure 2 shows results of the respiratory rate tests. From this figure we see that there was an obvious increase in the respiratory rates as the intense assignments were being done. The relationship between the increase of respiratory rates and the difficulty of the

assignments was not obvious. Respiratory rates from the experimental group before or after practicing Qigong in different kinds of situations remain constant. No obvious differences were found, which indicates that there was no effect on respiratory rates in a state of stress whether Qigong was practiced or not. Respiratory rates from the experimental group before practicing Qigong and the comparison group were very close. There was no obvious difference between the two groups which indicates that there was no obvious relationship of respiratory response in the state of stress between Qigong practitioners and non-practitioners.

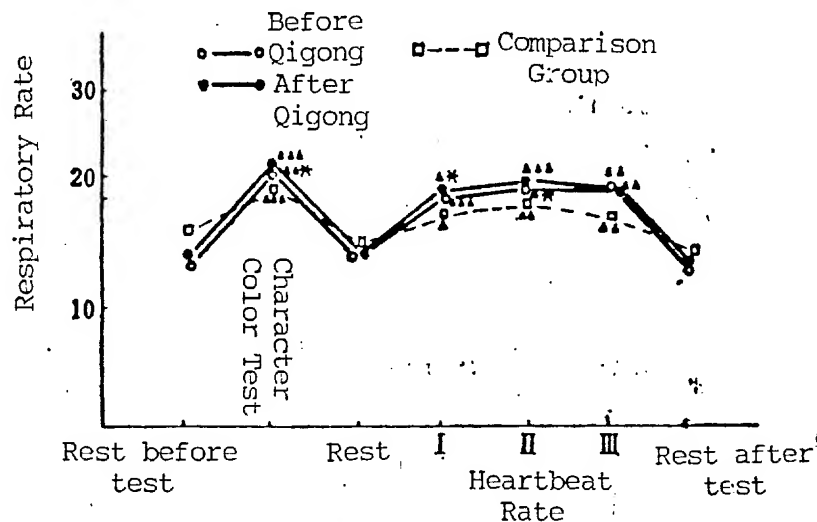


Figure 2. Respiratory rate changes in state of stress. Comparison with the first rest,  $\Delta p < 0.05$ ,  $\Delta\Delta p < 0.01$ ,  $\Delta\Delta\Delta p < 0.001$  comparison with non-Qigong practice \* $p < 0.05$

### 3. Adrenalin

Table 1 shows the excretion amount of the adrenalin. From the table we see that in the stress response experiment, the amount of adrenalin excreted from the three groups all increased dramatically. Excretion amounts after a one hour rest at the end of the experiment were lower than during the stress response experiment. Excreted amounts of adrenalin from the experimental group all decreased remarkably no matter whether Qigong was practiced before the experiment or not, however a decrease of the amount excreted from the comparison group has not reached a remarkable level.

Table 1  
Changes in Amount of Adrenalin Excreted (nmole/hr)

Groups:		Before Experiment	Stress Response Test	After one-hour rest
Experimental Group	After Qigong	2.4±0.7	4.3±1.9Δ	3.2±1.4*
	Before Qigong	2.4±1.2	4.4±1.7ΔΔ	3.0±1.4*
Comparison Group		3.0±1.6	4.4±2.4ΔΔ	4.0±2.2

Surface values + or - standard average value errors  
Comparison with before the experiment from the t test

Δp<0.05, ΔΔp<0.01

Compared with the stress response experiment t test \*p<0.05

4. There were no remarkable changes in the amount of noradrenaline excreted in the urine from both the experimental group and the comparison group before the experiment. There were also no obvious changes from the stress response test or after the one hour rest.

The excreted amount of noradrenaline from the experiment group when Qigong was practiced was remarkably higher than without Qigong practice before the experiment (see Table 2).

5. Subjective evaluations of intensity degrees. The subjects gave subjective evaluations as the intensity degrees during the experiment as (1) not nervous, (2) a little nervous, (3) nervous, (4) very nervous. The results are shown in Table 3.

From Table 3, we see that there were no obvious differences among the three groups. As the difficulty of the problems increased, subjective feelings of nervousness increased as well.

Table 2  
Changes in Amount of Noradrenaline Excreted in Urine (nmole/hr)

Groups:		Before Experiment	Stress Response Test	After one-hour rest
Experimental Group	Qigong Practice	11.4±3.4**	10.7±5.5	8.0±2.7
	No Qigong Practice	8.6±4.0	10.2±8.9	7.6±6.2
Comparison Group		8.7±4.1	8.5±5.3	9.7±3.9

Values in the table are taken as average value + or - standard errors

Compared with before Qigong practice (t tested as \*\*p<0.01).

Table 3  
Subjective Evaluations of Degrees of Nervousness

Groups		Character Color Test	Mental Arithmetic Tests		
			I	I	I
Experimental Group	Qigong Practice	$2.1 \pm 0.7$	$1.4 \pm 0.5$	$3.0 \pm 0.8$	$3.3 \pm 0.7$
	No Qigong Practice	$1.8 \pm 0.8$	$2.0 \pm 1.1$	$2.9 \pm 1.1$	$3.0 \pm 0.8$
Comparison Group		$1.8 \pm 0.7$	$1.4 \pm 0.7$	$2.5 \pm 0.7$	$2.7 \pm 0.7$

### III. Discussion

In order to eliminate effects caused by differences of types of Qigong, subjects in the experimental group were all Yangqigong practitioners.

Usually people mainly respond to characters but the colors of the characters. In our character-color test, subjects were required to respond only to colors of the characters but not the characters themselves. Moreover, there were 40 characters in red, green, yellow, and blue with each color on a different card. It was easy to make mistakes since characters involved a big interference. It was very difficult to write down the colors of all 40 characters in one minute accurately with this kind of interference. This put the subjects in a state of nervousness. Also, in the mental arithmetic tests it was difficult for the subjects to solve a math problem in seconds. In our experiment, subjects were put in a state of nervousness by being required to accomplish difficult assignments. The responses of their heartbeat rates, respiratory rates and number of catecholamines excreted were observed.

The problem we were interested in observing was whether Qigong could reduce the stress. In our experiment, the heartbeat rate, respiratory rate, and amount of catecholamines excreted of the subjects when in the process of completing the intense assignment all appeared to increase. Therefore, these three items were sensitive enough to be the index of stress response. Changes of noradrenaline excreted in the experiment was not remarkable, which was consistent with our previous study and the report by Frankenhaeuser; adrenalin is more sensitive than noradrenaline in stress response. Our experiment indicates that during the intense assignment tests, the heartbeat rates of the experimental group who practiced Qigong were much higher than when Qigong was not practiced beforehand.

There were no remarkable differences between having practiced Qigong and not having practiced in the the increase of respiratory rates and adrenaline. Therefore, we conclude that at least to Qigong practitioners, whether practicing Qigong or not beforehand does not remarkably reduce stress response. The increase in heart rates, respiratory rate, and excreted amount of adrenaline from the experimental group during the intense working period were similar to the comparison group. Therefore, at least Yangqigong could not reduce the stress response, which was consistent with Holmes' view. Of course, what Holmes meant was that meditation could not reduce stress. Meditation and Qigong are indeed not the same, but they have similarities. Practicing meditation also requires relaxation and abandoning of distracting thoughts.

It was also found from our experiment that the excreted amount of adrenaline in urine from the experimental group after a one-hour rest at the end of the experiment with or without practicing Qigong beforehand was obviously lower than the amount excreted during the stress response tests. For the comparison group, the decrease in excretion did not reach a remarkable level. This indicates that recovery of the excreted amount of adrenalin after the stress response test from Yangqigong practitioners seemed to be quicker than that of the comparison group. This indicates that Qigong may help in recovery from stress.

Effects of meditation on the autonomic nervous system have been a controversial problem. It is felt by some that meditation is a state of tropism; a nutritious parasympathetic function. However, Lang, et.al., found that senior meditation practitioners had higher amounts of catecholamines and metabolic products UMA excreted in their daily urine, and a higher amount of noradrenaline in their plasma when in meditation. They concluded that meditation might activate the sympathetic nervous system. Then what are the effects of Qigong on the autonomic nervous system? There have been very few reports on this question. Wang Zhongxing, et.al. concluded that Qigong could reduce the sympathetic nervous system after the practice based on the finding of Dopamine b-hydroxylase activities in blood pumping that decreased after patients with high blood pressure practiced Qigong. Will activities of the sympathetic nervous system be reduced after people with normal blood pressure practice Qigong? This was also a question we were interested in. In our experiment, all subjects had normal blood pressure. The results of our experiment showed that from the experimental group, those who had practiced Qigong had remarkably higher amounts of noradrenaline excreted in their urine and higher heart rates after a rest instead of having practiced Qigong (see Table 2). While working on the intense assignments, their heart rates were higher with Qigong practice than without Qigong practice beforehand (see illustration). The above results indicate that the sym-

### III. Discussion

1. In modern medicine, high blood lipoid diseases are considered as caused by a deficiency in lipoid metabolism. There is a close relationship between high lipoprotein and cardiovascular diseases caused by lack of blood. Therefore, it is important to control high cholesterol to prevent coronary atherosclerotic heart disease.[7] Qigong has certain prevention and curative effects on diseases such as hypertension and coronary atherosclerosis.[8,9] However, there have been very few reports concerning effects on lowering blood lipoids by Qigong. Our study indicates that high blood lipoids can be reduced in differing degrees after a relatively long period of time in Qigong practice, which is consistent with the report of results on lowering blood lipoids by Kuang Aafang from Shanghai Research Institute for Hypertension.[10] Since Qigong has an effect on lowering blood lipoids, it provides the biological and biochemical basis for the belief that Qigong can prevent and cure such diseases as coronary atherosclerosis, hypertension, and others.

2. Qigong is a method of exercising the body and mind as well as a theory of science. The amount of time spent practicing Qigong is a very important factor that can affect curing of disease as is evident from our study. Because patients in comparison group 2 practiced Qigong only for a short period of time, there were no obvious indications of lowered blood lipoids, even though these patients practiced the same type of Qigong. This indicates that effects of Qigong therapy are gradually accumulated over a long period of time. Therefore, Qigong should be practiced regularly and continuously. If Qigong is used for curing diseases, the number of days and amount of time of practice should be lengthy. Otherwise, it is impossible to achieve good curative effects. Yet the amount of time spent in Qigong practice should be decided according to the patient's situation and the type of Qigong practiced. If for the purpose of promoting health, the amount of time of practice can be reduced.

3. As therapy, Qigong is an effective treatment disease but it is not omnipotent. Even if it can provide a cure, it doesn't necessarily mean it will work on every patient. For example, we found three cases from a family which had a history of high blood lipoids. They all practiced Qigong seriously for a long period but the effects were not satisfactory. This indicates that Qigong cannot cure certain types of blood lipoid diseases and that other types of therapy should be used.

4. In our study, results showed no remarkable differences between triglyceride values of the patients from the Qigong group before or after they practiced Qigong ( $p > 0.05$ ). The reason, according to our analysis may have something to do with



the fact that most triglyceride values of these patients were a little higher than standard normal values ( $M + \text{or} - SD = 114.4 + \text{or} - 16.31 \text{ mg/dl}$ ). Since Qigong has bi-directional adjustment effects, it works better when deviating values are too high or too low. That is to say, its adjustment effects are more remarkable. But for those values that are within the normal physiological mechanism, variations are not remarkable. Therefore, there were no obvious differences in triglyceride values before or after Qigong practice.

#### Summary

1. 49 patients were observed in this study. Their cholesterol and VLDL decreased remarkably ( $p < 0.001$ ) after practicing Doayin-Tuna Qigong for 116.4 days. 22 patients who did not practice Qigong and 12 patients who had just started did not achieve the same results as the Qigong group, which indicates that Qigong reduces blood lipoids.
2. The effects of Qigong improved through long-term practice of Qigong continuously and seriously. Therefore, Qigong's therapeutic intensity should be achieved through increased amount of practice and treatment.

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## Bi-Directional Adjustment of Daoyin-Tuna Qigong on Blood Pressure and Heart Rates

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Daoyin Tuna Qigong originated among the people of Sanxi.[1] Having used this Qigong in medical practice, we found that it had good curative effects on certain cardiovascular diseases.[2] In order to study the pathological and physiological mechanisms of these curative effects, we observed the effects of Daoyin-Tuna Qigong on cerebral blood circulation and the pulse of finger tip volume.[3,4] This study also made detailed comparisons of blood pressure and heart rates.

### I. Method

Subjects of the observation: Hospitalized patients receiving Daoyin-Tuna Qigong consisten of 23 males and 15 females with an average age of 47.3. They were grouped according to blood pressure and heart rate situations.

Training of the Qigong Method: Daoyin-Tuna Qigong was practiced with Dong (movement) and Jing (still) procedures on alternate days for several months.

Testing Method: A Japanese made Sharp digital electric sphygmomanometer was used to show blood pressure and heart rates simultaneously. Blood pressure was measured at the arteries of the subject's upper left arm after sitting quietly for three to five minutes. Two measurements were made two or three minutes apart to obtain average values. The observations were made during hospitalization periods of 54 plus or minus 4.2 days after the Qigong therapy. Conditions of the patients before and after Jing or Dong gong methods were also observed. The measurement data was statistically processed by microcomputer.

### II. Results

1. Changes in Blood Pressure Before and After Treatment. According to the WHO diagnostic standard, blood pressure was grouped into high, low and normal. Results of blood pressure levels before and after Qigong treatment are shown in Table 1. We see that after Qigong treatment, in the high blood pressure group, systolic pressure decreased by an average of 18.5 mmHg. Differences were remarkable ( $p < 0.05$ ). Diastolic pressure decreased by an average of 6.9 mmHg. In the low blood pressure group, both systolic and diastolic

pressures tended to increase at the end of the treatment. There were no obvious changes in normal blood pressure groups either before or after treatment ( $p>0.1$ ).

Table 1  
Blood Pressure Variations Before and After Daoyin--Tuna  
Qigong Treatment

Groups	# of Samples	Blood Pressure before treatment (mmHg)	Blood Pressure after treatment (mmHg)
High Blood Pressure	13	180.5 $\pm$ 24.7/105.9 $\pm$ 15.1	162 $\pm$ 22.1/99 $\pm$ 11.9
Low Blood Pressure	3	88.7 $\pm$ 7.3/56.2 $\pm$ 6.8	89.3 $\pm$ 8.1/61.9 $\pm$ 7.2
Normal Blood Pressure	22	116.9 $\pm$ 15.3/73.4 $\pm$ 7.5	116.6 $\pm$ 13.4/72 $\pm$ 6.15

## 2. Variations in blood pressure before and after Jing and Dong Qigong methods.

Changes in blood pressure of 27 subjects tested before and after Jing Qigong. Average blood pressure before Jing Qigong was 120.6/72.1 mmHg. Average blood pressure after was 120.2/74.8 mmHg. There were no obvious changes. We further analyzed 9 people whose blood pressure was above 130/85 mmHg and 9 people whose blood pressure was below 100/70 mmHg before Jing Qigong. Results indicate that the group with higher blood pressure had an average blood pressure of 151.4/97.2 mmHg before Qigong and 144.7/94.5 mmHg after Qigong. The low blood pressure group however, blood pressure readings increased with the average blood pressure before Qigong being 94.8/59.7 mmHg, and 98.6/65.3 mmHg after.

Variations in blood pressure before and after Dong Qigong, Average blood pressure before Dong Qigong practice was 124.7/76.9 mmHg, and 126.3/77.4 mmHg afterwards. There were no obvious changes. In further analysis, we found that there was a decrease in blood pressure after Dong Qigong practice in the high blood pressure group with average blood pressure being 157.4/98.2 mmHg before Qigong, and 155.6/96.3 mmHg afterwards. There was an increase in the low blood pressure group after Qigong. Average blood pressure in this group before Qigong was 93.3/62.8 mmHg, and 99.8/66.8 mmHg after. These results indicate that there is a bi-directional adjustment effect of Qigong on blood pressure.

## 3. Variations in heart rates before and after Jing and Dong Qigong.

Average heart rate before Jing Qigong was 72.7 and 70.4 after. Average heart rates before Dong Qigong were 68.8 and 70.3 after. There were no obvious changes. We further

analyzed the groups whose heart rates were higher than 85 and lower than 65 before Qigong. We found that the group which had higher heart rates had an average rate of 90 before Jing Qigong, but 82.8 after. The average heart rate before Dong Qigong was 91 and 78 after. The average heart rate after Jing and Dong Qigong decreased by 7.2 and 11 beats per minute respectively. In the lower heart rate group before Qigong practice, the average heart rate before Jing Qigong was 52.3 and 58 after and average heart rate with Dong Qigong increased from 58.2 to 64.3 after. In both cases, heart rates increased 5.7 and 6.1 respectively. These results also indicate the bi-directional adjustment effect of Qigong on heart rates.

### III. Discussion

There have been reports concerning the effects of Qigong on blood pressure and heart rates from the human body but they all addressed unidirectional changes. (5,6) This study further observed bi-directional effects of Daoyin-Tuna Qigong on blood pressure and heart rates. Results before and after Qigong treatment indicate that blood pressure declined after treatment in the high blood pressure group, especially systolic pressure. There was also an increase in the low blood pressure group. Blood pressure and heart rates before and after Jing and Dong Qigong both tended to have bi-directional variations. Overall however, we see that with bi-directional changes in blood pressure and heart rate, there was a tendency to move from high to low rather than from low to high.

It is generally considered that Qigong is a method of relaxing body and mind. In Qigong, the sympathetic nervous system is in intense decline, and its mechanism causes low metabolism, low breath rates, low blood pressure and low heart rates. However, from our observation we found that not only these responses from the same Qigong method, but also opposite responses such as higher blood pressure and heart rates occurred as well. This is hard to explain using only the unidirectional analysis method. As a matter of fact, as one of the links of Qigong, the adjustment process has bi-directional characteristics. In other words, it can strengthen breathing and respiration by passing through the lungs, and cause the sympathetic and parasympathetic nervous systems to respond in excitement and inhibition alternatively. It can even readjust the activity form of the cardiovascular centers, and cause relevant responses in blood pressure and heart rate. Moreover, deep inhaling and exhaling are adjustment characteristics, so it is understandable that blood pressure and heart rate changes are bi-directional. In the Jing Qigong method, even though the adjustment was weak, selections for concentration on different points of the body by Qigong practitioners consciously or unconsciously can cause completely different responses of

the cardiovascular system (5,6). Also, variation of certain body fluid elements is a fact that should not be neglected and an issue for further research.

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## Observation of the Effects of Lowering Blood Lipoid with Daoyin-Tuna Qigong

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### Introduction

We observed effects of Daoyin-Tuna Qigong on diseases caused by high blood lipoid. Eighty-three patients in three groups were observed. There were 49 hospitalized patients who practiced Qigong in the group. 22 hospitalized patients did not practice Qigong in comparison group 1. 12 clinical patients practiced Qigong only for a short period of time in comparison group 2. Results: Blood lipoid values decreased obviously in the Qigong group after the patients practiced Qigong for an average of 116.4 days an average of 5 hours per day. The amount of blood lipoids decreased along with lower cholesterol, triglyceride, and B-lipoid protein by 75.5%, 67.4%, and 83.7% respectively. There were no obvious declines in comparison groups 2 and 3 which indicated that Qigong lowering blood fat levels. The length of time of Qigong practice was an important factor affecting curative effects. We also discussed the mechanism of the Qigong effects and factors.

Daoyin-Tuna Qigong may be said to be the "Ermei Qigong Method," which belongs to Tuna (Exhaling and Inhaling) style. This kind of Qigong is unique in its method of breathing, intensity of actions, and may work along with massage, which differs from most Qigong styles.[1] We have reported before [2,3] that Daoyin-Tuna Qigong has good curative effects on diseases caused by lack of blood in the heart and brain and chronic diseases caused by old age such as hypertension, coronary atherosclerotic heart disease, sequelae of apoplexy, and cerebral atheroscleroses. We also reported that there were changes in electro-encephalograms, rheoencephalogram, skin vascular movement, and the appearance rate of circulatory nerve sensibility of people with good Daoyin-Tuna Qigong skills, which indicates that Daoyin-Tuna Qigong can have good adjustment effects on many physiological functions.[4,1,5] This study further observed the effects of reducing blood lipoids by this kind of Qigong and effects of lowering blood fat caused by the length of time of Qigong practice. We also studied ways of curing diseases by Qigong and other factors.

## I. Method

### 1. Subjects of observation.

(1) 49 hospitalized patients in Qigong wards in the Qigong group consisting of 41 males and 8 females ranging in age from 33 to 76. The average age was 51.6. Diseases of these patients included mainly hypertension, coronary atherosclerotic heart disease, sequelae of apoplexy, cerebral atheroscleroses, chronic disease of old age such as bronchitis, emphysema, lack of muscular strength and silicosis. Elderly patients who had high blood fat were also included.

(2) 22 clinical patients in comparison group 1 who did not practice Qigong consisting of 8 males and 4 females ranging in age from 46 to 64. Average age was 56.7. Their diseases were the same as the Qigong group.

(3) 12 clinical patients who practiced Qigong for a short period of time in comparison group 2 including 8 males and 4 females ranging in age from 46 to 64. Average age was 56.7. Their diseases were the same as those in comparison group 2.

Patients in all three groups were seeking treatment because of other diseases, but were found to have higher blood fat than normal.

2. Type of Qigong. Doayin-Tuna Qigong was practiced by all patients in the Qigong group and comparison group 1. It was not practiced by comparison group 2.

### 3. Time of Qigong Practice.

(1) Qigong group: Dong Qigong was practiced about 1.5 to 2 hours every morning and evening. Jing Qigong was practiced about 1/2 hour to 1 hour every morning and afternoon. Total time of Qigong practice was about 5 hours. The length of time of Qigong practice gradually increased according to the situation of the patient. Average time of Qigong practice for patients in this group was 116.4 days.

(2) Comparison group 1: Qigong was not practiced by these patients. Average hospitalization was 98.2 days.

(3) Comparison group 2: Qigong was practiced less than 30 minutes per day. Total number of days of Qigong practice was 15 to 30. The average number of days was 24.3.

### 4. Observation Index:

Normal value of blood lipoids. According to "Practical Internal Medicine" and the situations in our laboratory, the standards for high blood lipoids were:



Serum cholesterol > (or equal) 130 mg/dl as the high, 200 - 229 mg/dl as very high.

Triglyceride > (or equal) 130 mg/dl as the high 100 - 129 mg/dl considered very high.

B-lipoprotein (very low density) > (or equal) 500 mg/dl as the high, 450 - 499 considered as very high.

If the patients had more than two items from above, they were included as subjects for observation.

## II. Results

### 1. Comparison of Qigong and non-Qigong groups.

(1) From cases with lowered blood lipoids shown in Table 1, we see that a higher number of cases in which blood lipoids decreased came from patients who had practiced Qigong.

(2) From the statistical analysis of the blood lipid values (Table 2), we see that cholesterol and VLDL (very low density) lipoprotein values of patients in the Qigong group decreased obviously after Qigong practice ( $p < 0.001$ ). Table 3 indicates that cholesterol (VLDL) values of those from the non-Qigong group were a little higher when they left the hospital than when they entered. However, there were no remarkable differences ( $p > 0.5$ ) after the data was processed, which indicates that Qigong practice can reduce blood lipoids. There also were no obvious differences in Triglyceride values before of after Qigong practice ( $p > 0.05$ ,  $p > 0.10$ ).

Table 1  
Case Statistics of Variations in Blood Lipoid Values between Qigong and Non-Qigong Group 1

	Qigong Group (N=49)		Comparison Group 1 (N=22)	
	Reduction (cases) %	Increase (cases) %	Reduction (cases) %	Increase (cases) %
Cholesterol	37 75.5%	12 24.5%	10 45.5%	12 54.5%
Triglyceride	33 67.4%	16 32.6%	9 40.9%	13 59.1%
VLDL	41 83.7%	8 16.3%	8 36.4%	14 63.6%

Table 3  
Excreted Amount of Urinary Catecholamines from Yangqigong Practitioners (nmole/hr).

Length of Time of Qigong Practice	No. of times tested	Adrenaline		Noradrenaline	
		Without Qigong	With Qigong Practice	Without Qigong	With Qigong Practice
More than two years	16	2.4±1.5	3.4±2.5*	8.8±4.1	9.1±2.6
Less than two years	18	1.7±1.2	1.9±1.9	6.1±2.5	7.6±3.8

t test comparison with no Qigong practice, \*p<0.05

Table 4  
Excreted Amount of Urinary Catecholamines from Zhanzhuanggong (nmole/hr).

Length of Time of Qigong Practice	No. of times tested	Adrenaline		Noradrenaline	
		without Qigong	with Qigong	without Qigong	with Qigong
more than two years	17	1.2±0.7	2.1±1.4**	8.7±4.6	9.0±4.9
less than two years	19	1.9±1.0	1.9±1.4	8.6±4.4	10.4±4.8

t test comparison with no Qigong practice. \*\* p<0.01

It is shown in Tables 3 and 4 that the excreted amounts of the adrenalin for those who practiced Zhanzhuanggong and Yangqigong more than two years increased remarkably. For those who had practiced Qigong less than two years, there was no remarkable change in the excreted amount of the adrenalin gland. This indicates that there is a relationship between the length of time of Qigong practice and the amount of catecholamines excreted.

### III. Discussion

It is seen from these results that no matter what kind of Qigong, the amount of urinary catecholamines excreted appears to increase. Though some of the increases did not reach a remarkable level, there has not been a decrease in excreted amounts after any kind of Qigong practice. Moreover, there is a relationship between the length of time Qigong practice and amounts excreted. There was a remarkable increase in the amount of adrenalin excreted after Qigong practice from those who had practiced Yangqigong and Zhanzhuanggong more than two years. The average period of

Table 2  
Comparison of Blood Lipoid Values Before and After Qigong Practice from Qigong Practice

	Before Qigong	After Qigong
	$M \pm SD$ mg/dl	$M \pm SD$ mg/dl
Cholesterol	$292.10 \pm 63.55$	$263.60 \pm 55.94 < 0.001$
Triglyceride	$114.40 \pm 16.31$	$111.00 \pm 15.37 > 0.05$
VLDL	$665.00 \pm 233.22$	$527.40 \pm 229.81 < 0.001$

Table 3  
Comparison of Blood Lipoid Values in Comparison Group 1 as Patients Entered and Left Hospital

	At entering Hospital	Leaving Hospital	p value
	$M \pm SD$ mg/dl	$M \pm SD$ mg/dl	
Cholesterol	$311.20 \pm 44.29$	$306.80 \pm 47.94$	$> 0.5$
Triglyceride	$125.60 \pm 11.37$	$127.50 \pm 11.45$	$> 0.1$
VLDL	$762.22 \pm 164.89$	$776.50 \pm 178.78$	$> 0.5$

2. Comparison of effects on lowering blood lipoid by different lengths of time in Qigong practice.

(1) Comparison of number of cases with lowered blood lipoids.

Table 4 lists statistics on numbers of cases in which patient's blood lipoid values changed from comparison group 2 (clinical patients who had only practiced Qigong for a short period). This indicates that if the period of time of Qigong practice was too short, the number of cases in which the blood fat value was reduced was almost equal to the cases in which the blood lipoids increased, which was obviously different from the statistics in the table showing most of the cases having a decrease in blood lipoids in the Qigong group.

Table 4  
Case Statistics of Variations in Amount of Blood Lipoids  
from Qigong Group and Comparison Group 2

	Qigong Group (N=49)		Comparison Group 2 (N=12)	
	Reduction (cases) %	Increase (cases) %	Reduction (cases) %	Increase (cases) %
Cholesterol	37 75.5%	12 24.5	7 58.3	5 41.7
Triglyceride	33 67.4	16 32.6	6 50.0	6 50.0
VIDL	41 83.7	8 16.3	5 41.7	7 58.3

(2) Statistics on variations of blood lipid values. From Table 5, we see that for those who practiced Qigong for short periods of time (less than 30 minutes per day with total practice time less than 30 days), there were no obvious changes in their blood lipid values before or after Qigong practice ( $p < 0.1$ ), which indicates that there was a remarkable effect on lowering the blood lipoids with increased Qigong practice (including days of Qigong practice and the time of Qigong practice each day). The longer Qigong was practiced, the more obvious were the effects of lowering the blood lipoids. If the time of Qigong practice was too short, then the results were not obvious.

Table 5  
Case Statistics of Changes in Amount of Blood Lipoids from  
Comparison Group 2 Before and After Qigong Practice (n=12)

	Before Qigong	After Qigong	p value
	$M \pm SD$ mg/dl	$M \pm SD$ mg/dl	
Cholesterol	$297.50 \pm 32.33$	$311.83 \pm 48.81$	$> 0.2$
Triglyceride	$124.60 \pm 6.51$	$127.50 \pm 13.33$	$> 0.2$
VLDL	$658.20 \pm 87.22$	$689.20 \pm 112.02$	$> 0.1$

**Primary Study of Effects on "True Qi Movement Method" on  
Functional Index of the Endocrinology of Children**

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Qigong is a precious cultural heritage of our country. The effects of Qigong on the human body are very complicated. Qian Xueshen pointed out that there will be a new scientific revolution once we combine Qigong and traditional medicine with modern scientific techniques.

There have previously been reports on the effects of Qigong on the endocrinology of the human body. [1] In order to further study the effects of the "True Qi Movement Method" [2] on endocrinology, we tested four functional indices of endocrinology on children before and after they practiced Qigong.

**I. Subjects of Observation and Method.**

67 healthy students were observed in our study. Among them were 28 males and 39 females. Their ages ranged from 13 to 16 with average age being 14.68. Observations were made before and after the Qigong practice period (90 days). Blood was drawn from the subjects in two groups before and after Qigong and refrigerated for examination after the serum was separated.

The experimental method used was the radio immunity testing method.[3] T3 T4 medications were offered by the Shanghai Chemical Reagent Institute. Cortex alcohol and growth hormone were offered by the Shanghai Biology Products Institute. Instructions for the usage of these products were followed.

**II. Results**

The attached table lists results of four items before and after the 67 subjects received the True Qi Movement Method. 97% of the subjects (65 out of 67) had reduced levels after Qigong treatment. Reductions ranged from 0.21 to 1.64 ng/ml. The T4 of 18 subjects (26.9%) increased. Increases ranged from 0.06 to 10.66 ug%. 67 subjects were tested for cortex alcohol. 22 (32.8%) showed increased amounts ranging from 0.3 to 13.5 ng/ml. 45 showed reduced amounts ranging from 0.4 to 17.1 ng/ml. The growth hormone of 43 subjects (64.2%) increased with ranges between 0.3 and 18.2 ng/ml. 24 (35.8%) cases showed reductions with ranges from 0.2 to 23.5 ng/ml.

Four Items of Endocrinology of 67 Juvenile Subjects Before and After True Qi Movement Method (X + SD)

Tests	T <sub>3</sub> ng/ml	T <sub>4</sub> µg %	Cortex Alcohol ng/ml	HGH ng/ml
Before Qigong	1.81±0.36	14.71±3.47	15.99±4.33	7.11±5.4
After Qigong	1.03±0.21	12.17±3.69	12.48±4.97	8.86±6.16
t	16.64	3.81	5.07	1.6
p	<0.001	<0.001	<0.001	>0.05

### III. Discussion

[Shan Dian Jiazuang Xian Yun An Suan--Transliteration of Chinese Term] (T<sub>3</sub>) and Thyroxine (T<sub>4</sub>) have extensive biological effects. The thyroid gland functions however, are limited by many factors such as the amount of inorganic iodine absorbed, some chemical and physical factors and other stress response effects. The thyroid gland is therefore controlled and adjusted by the endocrinology system to maintain a normal nervous or metabolism situation.[4] The amount of T<sub>3</sub> and T<sub>4</sub> in the subjects after their Qigong practice decreased which indicates that due to the True Qi Movement Method, concentration increased and distracting thoughts decreased. The cerebrum remained in a state of peace so that energy in the cerebrum area could remain focused. Thus there was a qualitative change in brain functions. In other words, Qigong directly stimulates the coordination of the central nervous system in the cerebrum. On the other hand, this result could be connected with lower-thalamus through the thalamus to all parts of the body. The lower thalamus is the autonomic nervous center. All body signals can be transmitted through thalamus to the forebrain area which deals with conscious thinking. The forebrain can also send out conscious messages to the lower thalamus which leads to high levels of coordination of physiological activities. The gradual process from "no order" to "in order" enables the cerebrum nerves to be relieved of tension so that fatigue dissipates.

Cortex alcohol is a hormone secreted by the adrenal cortex. These secretion functions are not automatic. Instead, the control and adjustment functions are directed by the central nervous system and the cerebral cortex through thalamus. There is a close relationship between the pituitary gland and the contact of the nervous system with the environment. Cortex alcohol levels secreted decreased after Qigong practice due to the True Qi Movement Methods dredging of channels and subsidiary channels in the body and strengthening the self-adjustment function. Thus the replenishing rate of protein decreased and the variation in enzymatic activities

strengthened immunity. Since composing and secreting of the adrenal cortex hormone in the body is adjusted by the hormone that stimulates the adrenal cortex released by the pituitary gland and the secretion of hormones that stimulates the adrenal cortex is adjusted by the lower thalamus, the adjustment effect is achieved through the lower thalamus by secreting releasing factors. The True Qi Movement Method reduced all kinds of feelings to their lowest levels by self-restraining effects, which placed the cerebrum in a particularly self-restraining situation. Therefore, the composing and releasing of the adrenal cortex hormone decreases, and the adjustment of the mechanism, balance of Ying and Yang, and the dredge of channels and subsidiary channels in the body are achieved.

Growth hormone is a protein hormone released by the pituitary gland. The adjustments in growth hormone are affected by many factors both inside and outside the body. These factors usually stimulate nerve centers directly or indirectly to affect the lower thalamus which deals with the adjusting and releasing of the growth hormone and causes the secretion of gland hypo-physics. However, statistics show that no obvious differences in the amount of growth hormone secreted before and after Qigong which is inconsistent with previous results. In the report from the Mahazuish European Research University in Switzerland, it was reported that for people who practiced Qigong for a long period of time, the efficiency of their physiological functions increased, biochemical systems that adjust the balance of organisms were more stable and accurate, metabolism rates decreased, the growth hormone secreted also decreased, and the efficiency of the stability mechanism increased. There has been no report however, of study of the endocrinology of the juvenile. As to the fact that the subject's growth hormone increased after Qigong in our study, we assume that this may be caused by the content of the growth hormone in plasma due to their age while they were in the growth period. There is a relationship between the secretion rate and the maturity of the central nervous system. Only the plasma growth hormone in youth is close to the level of that in an adult.

As to changes of endocrinology after Qigong, we assume this may be caused by the True Qi Movement Method meditation which adjusts the breath, concentrates on non-Qigong disturbing thoughts the concentration of internal adjustment, which leads the cerebrum to a process of internal restraint. Modern medical science also proves the objective effect between spirit and body which is achieved from the cerebral cortex, lower thalamus, reticular agitation system, through the autonomic nervous system and the endocrinology systems. The beneficial effects of Qigong on the body result from Qigong exercising the cerebrum, enabling the cerebrum to achieve a state of Qigong exceptional function, which makes internal organs function with their intrinsic potential to fulfill purposes of promoting health and curing disease.

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### Effects of Zhoutian Mingmen Qigong on Malignant Tumors

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Malignant tumors are one of three leading causes of death in the world. More than 700,000 people die from them in our country each year. Presently, malignant tumors are treated mainly through operations, radiation and chemicals. The common factor of these treatments involve killing tumor cells, however healthy cells are also killed in the process especially in radiation and chemical treatment. Healthy organs, particularly marrow, the alimentary canal, reproductive cells and the central nervous system can be functionally and organically damaged.[1] If further damage occurs, functions of producing blood by marrow and immunity decrease in effectiveness. Leukocytes, thrombocytes, and hemoglobins are then not produced in the necessary numbers. Also, elements restraining the organic immunity are produced.[2] Treatments are not always suspended at this point.

It is our view that in Qigong practice, the body enters into a state of Qigong which differs from a normal situation. Qigong enables a person's vitality to be stimulated, utilized and concentrated enabling channels and collaterals to be dredged, regulate one's vigor and adjust irregularities of the internal organs. Thus the purposes of promoting health and curing disease can be achieved by Qigong practice. Therefore, we did some primary studies on Qigong treatments on malignant tumors by observing variations in laboratory hemogram indices of the transforming functions of T-lymphocyte and 17-hydrocarbon cholesterol. Positive results of Qigong practice were achieved.

#### I. Subjects of Observation

80 hospitalized patients were observed. Among them were 48 males and 32 females. The oldest was 75 and the youngest 26 with average age being 51. Patients were divided into three groups according to the treatment method. Group 1 involved chemical treatment of 12 males and 13 females. Group 2 involved Qigong and chemical treatment of 14 males and 11 females. Group 3 involved Qigong treatment only of 22 males and 8 females. Sixteen kinds of malignant tumors were included (see Table 1). Patient's were diagnosed using the cytology method and x-ray exams. Most tumor patients had had operations, radiation, and chemical treatment (stages I or II) or had taken traditional Chinese medicines before they were hospitalized. Few were in the late stage of spreading metastasis.

## II. Methods of Qigong Practice and Experiments

1. The Qigong group was trained in "Chotian Mingmen Qigong" by Professor Lo Shen, author of this article. Qigong practice consists of eight Qigong methods including; Tunyueshong, Jinggong, Diegun, Zhanzhuanggong, and Mingmen Daiji Donggong. Traditional Chinese medicines were used as supplementary treatment. The Qigong and chemical treatment group had the same simultaneous treatment as Group 1. Group 3 mainly had chemical treatment. Primary medicines used were Changchun New Alkali, cyclophosphamide, 5-Fluorouracil [Piying Lu Su--transliteration of Chinese term], and phrimethylamine. Traditional Chinese medicines were also used for supplementary treatment. Qigong training and observation lasted 60 days.

2. The amount of erythrocytes, leukocytes, hemoglobin, and thrombocytes (by laboratory routine test) in the blood before and after treatment. The T-lymphocyte transforming function ( $H^3$ -TdRLT) was part of the patient's examination. Also, 24 hours before and after the last week of Qigong treatment, the amount of 17-hydrocarbon cholesterol excreted in the patient's urine was tested (with colorimetric analysis). The attached figure illustrates the comparison between listing the 17-hydrocarbon cholesterol excreted of five patient's urine 24 hours before and after Qigong practice. ( $Z + \text{or} - SD 482 + \text{or} - 2.5055$ ),  $t \text{ value} = 3.3478$ , ( $p \text{ value} < 0.05$ ).

## III. Results

1. Hemogram variations before and after the treatment. In 30 cases from the Qigong group, the patient's leukocyte, erythrocyte, and hemoglobin values all increased obviously ( $p < 0.01$ ) after Qigong practice. There were no obvious changes in the thrombocyte value ( $p > 0.05$ ). The leukocyte value of the patients from the Qigong-chemical treatment group all increased slightly, but not remarkably ( $p > 0.05$ ). Their erythrocytes, thrombocytes, and hemoglobin all increased remarkably ( $p < 0.01$ ). There were decreases ( $p < 0.05 - 0.01$ ) in the leukocytes, erythrocytes, hemoglobin and thrombocytes of the 25 patients from the chemical treatment group (see Table 2). The erythrocytes and hemoglobin increased obviously ( $p < 0.01$ ) after the 14 patients in the Qigong treatment group practiced Qigong. Their leukocytes and thrombocytes also increased ( $p < 0.05$ ). (See Tables 2 and 3).

Table 1  
Statistics of Types of Malignant Tumors of Patients

Tumor Types	Treatment Groups	Chemical Treatment Group	Qigong Chemical Treatment Group	Qigong Group
nasopharyngeal carcinoma		2	3	14
breast cancer		5	7	2
lung cancer		7	3	4
stomach cancer		4	3	1
esophagus cancer		2	1	1
vocal chord cancer		—	—	1
adenoma cancer		—	2	—
tonsil cancer		—	1	1
lymph gland cancer		1	1	1
testicle cancer		—	—	1
ovary cancer		—	—	1
uterine cancer		—	—	1
tongue cancer		—	1	1
pancreas cancer		1	—	—
liver cancer		2	—	—
larynx cancer		—	1	—
Total Cases		25	25	30

2. Variations in the T-lymphocyte cell transforming function ( $H^3$ -TdRLT) before and after Qigong practice. The  $H^3$ -TdRLT of six patients from the Qigong group increased remarkably after Qigong practice ( $p < 0.05$ ). There were no obvious variations in the results of 7 patients from the Qigong-chemical treatment group, however ( $p > 0.05$ ). The  $H^3$ -TdRLT of 7 patients in the Qigong group who had cancer of the nasopharynx increased remarkable after Qigong practice ( $p < 0.01$ ). (See Table 3).

**Table 2**  
**Statistics of Hemograms of all Patient's with Malignant Tumors Before and After Treatment**

Items Observed	Groups	Chemical Treatment Group (n=25)	Qigong Chemical Treatment Group (n=25)	Qigong Group (n=30)	Qigong Group with cancer of Nosopharynx (n=14)
Leuocyte 10000/mm <sup>3</sup>	Before treatment Z <sub>1</sub>	7088	5808	4750	4207.14
	After treatment Z <sub>2</sub>	4793.6	5860	5720	5500
	Variation before and after Z±SD	↓ 2294±637.86	↑ 52±409.88	↑ p20±352.01	↑ 1292.86±1971.51
	t value	3.59	1.269	2.7556	2.45
	p value	<0.01	>0.05	<0.01	<0.05
erythrocyte 10000/mm <sup>3</sup>	Before treatment Z <sub>1</sub>	321.6	341	327	326.07
	After treatment Z <sub>2</sub>	289	263.2	365.833	374.64
	Variation before and after Z±SD	↓ 32.6±8.55	↑ 22.2±6.50	↑ 38.83±8.56	↑ 48.57±54.61
	t value	3.8131	3.415	4.5389	3.33
	p value	<0.01	<0.01	<0.01	<0.01

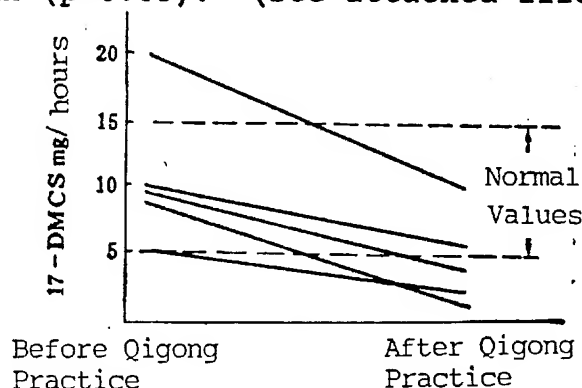
**Table 2 (continued)**

Items Observed	Groups	Chemical Treatment Group (n=25)	Qigong & Chemical Treatment Group (n=25)	Qigong Group (n=30)	Qigong Group with Cancer of Nosepharynx (n=14)
Haemoglobin g/%	Before Treatment Z <sub>1</sub>	9.612	10.308	9.563	9.72
	After Treatment Z <sub>2</sub>	8.436	10.868	11.02	11.24
	Variation Before and After Z±SD	↓ 1.176±2.95	↑ 0.56±1.74	↑ 1.457±2.76	↑ 1.54±1.67
	t Value	3.9899	3.2207	5.2817	3.46
	p Value	<0.01	<0.01	<0.01	<0.01
Blood Platelets 10000/mm <sup>3</sup>	Before Treatment Z <sub>1</sub>	14.784	11.584	11.123	10.21
	After Treatment Z <sub>2</sub>	↓ 11.796	11.892	12.446	12.18
	Variation Before and After Z±SD	↓ 2.588±1.24	↑ 0.308±0.84	↑ 1.323±9.11	↑ 1.99±3.43
	t Value	2.0909	3.6714	1.452	2.17
	p Value	<0.05	<0.01	>0.05	<0.05

Table 3  
T-Lymphocyte Transforming Function ( $H^3$ -TDRLT) of Patients  
Before and After Qigong Practice

Items Groups	No. of Cases	cpm/0.1ml <sup>a</sup> Z+ SD Before Qigong	cpm/0.1ml <sup>a</sup> After Qigong	t Value	p Value
Chemical Qigong Treatment	7	4378.4±2010.6	36715±19601	0.67	>0.05
Qigong Treatment	6	7256.7±5823	31171±23112	2.46	<0.05
Qigong Group with Cancer of Nasopharynx	7	5312.14±3250.98	20526.57±13630.97	3.64	<0.01

3. Excretion variations of 17-hydrocarbon cholesterol in urine before and after Qigong Practice. There were remarkable decreases in the amount of 17-hydrocarbon cholesterol or five patients from the Qigong group who had cancer of the nasopharynx ( $p < 0.05$ ). (See attached illustration).



Picture attached

#### IV. Typical Cases

Case 1: Mr. Jian, male, age 47, public servant. Hospitalization number 00110. Mr. Jian received cobalt-60 radiation treatment in Hangzhou Tumor Hospital one year ago due to cancer of the nasopharynx. He was not able to work due to migraines, exhaustion, cold sweat, blood snivel, and depression. There was no improvement after using several types of medication. He joined the Qigong treatment in our hospital in March, 1985. He was found to be wan, sallow and weak. His leukocytes measured at  $2400/\text{mm}^3$ , hemoglobin at 8g%, and  $H^3$ -TdRLT at 5942 cpm/0.1 ml. After two months of Choutian Mingmen Qigong practice, all of his symptoms disappeared. His physique improved. The leukocytes were re-

measured at  $4000/\text{mm}^3$ , thrombocyte at 370 per  $10000 \text{ mm}^3$ , hemoglobin at 11.2g%,  $\text{H}^3\text{-TdRLT}$  at 17710 cpm/0.1 ml (an improvement of 300%). He was able to work normally after leaving the hospital.

Case 2: Mr. Yang, male, age 35, driver. Hospitalization number 00103. Mr. Yang also received cobalt-60 radiation treatment in Hangzhou Tumor Hospital six months before because of cancer of the nasopharynx. He had been staying home since then due to dizziness, weakness, and a seriously stuffed up nose. He joined the Qigong treatment group in March, 1985. His thrombocytes tested upon entering the hospital were 300 per  $10,000 \text{ mm}^3$ , leukocytes at  $5100/\text{mm}^3$ , hemoglobin at 9g%,  $\text{H}^3\text{-TdRLT}$  at 11361 cpm/0.1 ml. After two months of Qigong practice, all of his symptoms disappeared. His thrombocytes were re-measured at 355  $10,000 \text{ mm}^3$ , leukocytes at  $6500/\text{mm}^3$ , hemoglobin at 11g%,  $\text{H}^3\text{-TdRLT}$  at 26174 gm/0.1 ml (200% greater). He is now back at work.

#### IV. Discussion

1. It is felt that in traditional medicine, causes of tumors result from long-term irregular diets, depression, internal lesions caused by overexertion, externally unhealthy environmental influences which cause imbalances of Ying and Yang, vital energy and blood circulation; deficiencies of internal organs, channels and collaterals. This results in stagnation of the circulation of vital energy and blood flow, accumulation of humidity and illness, and collections of unhealthy obstacles. The saying, "If the internal organs lose true Qi, then evil Qi emerges (Zhong zhangjing). In other words, if there is a deficiency of vital energy and blood, all kinds of diseases thus emerge (NeiJing). Therefore, principles of treatment are based on eliminating unhealthy elements and providing vital energy, dredging channels, collaterals and blood circulation. Cases from our study prove that all chemical examination indices of patients after they practice Qigong changes remarkably. Even in the Qigong-chemical treatment group, there were obvious decreases ( $p < 0.01$ ), which basically stayed on the level of that before treatment ( $p > 0.05$ ). But there were remarkable increases in erythrombocytes and leukocytes ( $p < 0.01$ ). This indicates that Choutian Mingmen Qigong could not only reduce the side effects of chemical treatment and help the internal organic situation to be in balance in order to improve organic ability of the chemical treatment, but also improve the body's ability to produce blood and immunity, and strengthen physique.

2. It is shown by modern medical research that changes and abnormal situations of the main elements in blood such as leukocyte, erythrocyte, hemoglobin, and thrombocyte reflect the organic situation of the human body, which are the most important indices. Our study indicates that after a two-

month self-adjustment, all physiques of the 30 patients in the Qigong group have improved dramatically. There were remarkable increases in their leukocytes, erythrocytes and hemoglobin ( $p < 0.01$ ), yet there were no obvious changes in thrombocyte ( $p > 0.05$ ). Erythrocyte and hemoglobin of the 14 patients from the Qigong group who had cancer of the nasopharynx increased obviously ( $p < 0.01$ ). There were also increases in their leukocyte and thrombocyte ( $p < 0.05$ ). Improvements in organic ability of delivering oxygen and other nutritious substances resulted from the increases of erythrocyte and hemoglobin. The ability to provide energy also improved which helped the recovery of tumor patient's metabolism functions. It was also found recently that erythrocytes can adjust the ability of organic self-protection. Recent research indicates that leukocytes contain many kinds of enzymes, which have engulfing ability. Therefore, improvements in biological functions (leukocyte, erythrocyte, hemoglobin, and thrombocyte) are the basis of Qigong treatment on malignant tumors.

3. Mr. Liu Qinglun reported 125 cases of cancer of the nasopharynx diagnosed by the pathological method which had not yet received treatment. He found that after radiation treatment, for those who had low  $H^3$ -TdRLT, the prognosis was unfavorable. Their life expectancy was short. Those who had better immunity however, lived longer.

It is assumed in modern medicine that there is a close relationship between cellular immunity, appearance of and development of tumors. There is however, a limit to organic immunity potential. When tumor cells exceed  $10^5 \times 10^8$ , they cannot all be killed. If there is a small number of tumor cells and the patient has a good cell immunity system, then the tumor cells can be killed effectively by the immunity system and metastasis can be prevented. Therefore, it is very important to improve the immunity system. In our study, 7 patients in the Qigong group who had cancer of the nasopharynx practiced Qigong for two months to stimulate the organic immunity system. The results prove that their  $H^3$ -TdRLT ability improved. There were obvious differences before and after Qigong practice ( $p < 0.01$ ).

4. Our study shows that after about 50 days of Qigong practice, the 17-hydrocarbon cholesterol excreted in the urine of the five patients who had cancer of the nasopharynx in the Qigong group appeared to decrease. This result was consistent with the conjecture made by an Australian doctor, who explained that practicing Jingzho Qigong (peaceful sitting Qigong) can reduce the cortex hormone level and strengthen the immunity of the body by reaching a calm state.

Our reasoning: 1. By relaxing the cerebral cortex, Qigong keeps the brain in a working state, which brings negative feedback of the cerebral cortex hormone into full play and

also helps the nerve fluid system to be balanced and the hormone level to be reduced. 2. Qigong practice can keep vital energy and blood circulating, improve blood producing ability, nourish the kidney, and recuperate Ying and Yang, so that the adrenalin secreting hormone is adjusted adequately.

5. Zhoutian Mingmen Qigong is mainly an emphasis on exercising the Jing, Qi, Jing in the body. In different Qigong states, special breathing techniques, and self-controlled thought, internal Qi (YunQi) is stimulated to circulate following the channel nets to reach a balance of Ying and Yang. It also adjusts the vital energy and blood circulations, dredges the channels and collaterals, and helps in the adjustments and recovery of biological functions in the body. Our study indicates that erythrocyte, leukocyte, hemoglobin, thrombocyte, the immunity system, and endocrine system in the body are all involved in this adjusting process.

According to the report from Feng DaLi, the efficiency rate of destruction of cancer cells directly by external Qi is 30.72%. Is there a direct effect on destroying cancer cells by internal Qi? This is still a problem which needs to be solved. Our study however, indicates that there are reliable effects and a substantial basis for proving that Qigong treatment can prevent and cure malignant tumors.

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# Clinical Efficiency and Mechanism Approach of Eye's Qigong Exercise to Treat Myopia

Wang Yugin, Zhang Guifang, and Wang Ximing (Jiamusi Medical College)

The eye Qigong exercise was invented by our research group through scientific theories and clinical experience. The whole program includes eight steps. [1,2]

Step 1. Preparation posture (see figure 1). Separate the feet to shoulder width. Drop arms naturally. Look forward with both eyes.

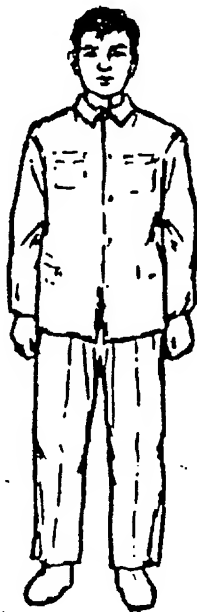


Figure 1. Preparation posture

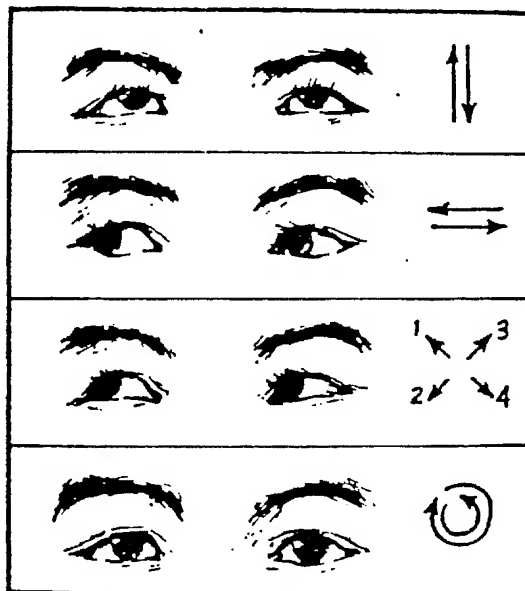


Figure 2. Eye turning

Figure 1. caption needed

Figure 2. caption needed

Step 2. Rotating the eyes (see Figure 2). Rotate the eyes up, down, left, right, and across in clockwise and counter-clockwise directions.

Step 3. Tiger-like glare (see Figure 3). Close the eyes and rest for 20 seconds then open the eyes widely and stare forward for about 10 seconds.

Step 4. Developing Qi with eyes closed (see Figure 4). Slowly close the eyes after Step 4. Stand still.

Step 5. Directing Qi by opening and closing hands (see Figure 5). Place the hands in front of the chest with palms facing each other. Slowly pull apart the palms and then slowly push them back. Repeat 16 to 32 times.



Figure 3. Tiger-like glare

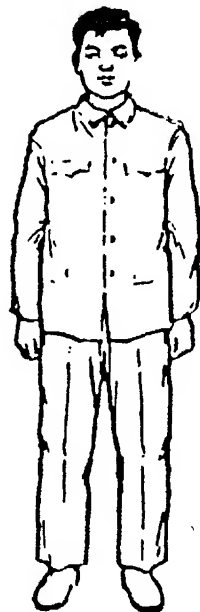


Figure 4  
Developing Qi with  
closed eyes

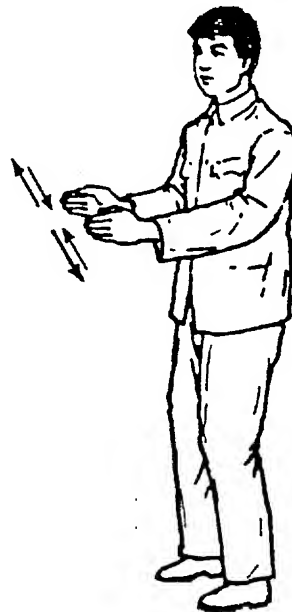


Figure 5  
Directing Qi by  
opening and closing  
hands



Figure 6  
Pushing close and  
pulling far

Step 6. Pushing near and pulling far (see Figure 6). Turn the palms facing upward. Slowly move them in front of the eyes. Slowly pull the hands away with palms facing the eyes then slowly push the palms toward the eyes. Repeat 16 to 32 times (2x8 or 4x8 beats).

Step 7. Massaging Eye Areas (see Figure 7). Place the hand about two inches away, then move the hand around the eye balls clockwise eight times. Then turn hands counterclockwise eight times.



Figure 7. Massaging Eye Areas

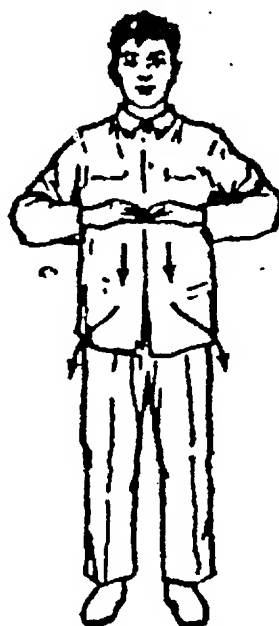


Figure 8. Directing Qi back to vitality

Step 8. Directing Qi back to vitality. Move two hands down slowly from both sides of the nose. When the hands move to the front of the chest, turn the palms downward. Continue to move the hands down toward the Dantian acupoint, then move them to the sides of the body. Repeat three times. Return to preparation posture.

#### I. Results of the Eye Qigong Exercise

We observed the effects of 528 college, middle school, and elementary school students. The average efficiency was 75.64% (see Table 1). The relationship between different treatments and the curative effects was also observed. The cure rate was 8.21% for the group (134 eyes) who had practiced the Qigong eye exercise for eight days. Of the 450 eyes who practiced the Qigong eye exercise for one month, the cure rate was 26.67% ( $t=3.51$ ,  $p<0.01$ ), which was obviously higher than the previous group.

The diopter of the vision was tested (see Table 2). There were no obvious changes in the group who had practiced Qigong for eight days, but the diopter of the subject's changed remarkably in the group that practiced Qigong for one month. Comparing the different diopters, it was found that the average diopter value of eyes below  $-3.00D$  was  $p<0.01$ . For the 30 eyes with diopter between  $-3.00D$  to  $-6.00D$ , the average diopter value was  $p<0.05$ , which shows an obvious difference. There was no obvious difference for the 10 eyes above  $-6.00D$  ( $p>0.05$ ).

**Table 1**  
Cure rate of the Qigong Eye Exercise on 528 Eyes

	No. of Sub-jects	Total No. Eyes	Corrected	Improved	No Effects	Effective
			No. of Eyes %	No. of Eyes %	No. of Eyes %	No. of Eyes %
College	17	30	2 6.67	8 26.67	20 66.67	10 33.33
Middle School	265	493	78 15.82	274 55.59	141 28.60	352 71.40
Ele. School	248	441	137 30.99	231 52.26	74 16.74	368 83.26
	528	965	217 24.49	513 52.16	235 24.35	730 75.64

**Table 2**  
Comparison of Course of Treatment and Average Values of Diopter

Course of Treatments	No. of Eyes	Average values of Diopter		t Value	p Value
		Before	After		
8 months	134	-2.64	-2.59	0.12	>0.05
1 months	412	-1.65	-1.35	3.92	<0.01

From clinical observation, we found that elementary school, high school, and college students who had practiced Qigong seriously had lesser degrees of myopia than those who had not. Other groups were also compared and observed while conducting the Qigong eye exercises (see Table 3).

**Table 3**  
Comparison of Four Types of Treatment of Myopia

Groups	No. of Eyes affected	No. of Eyes Unaffected	Total No. of Eyes	Efficiency %
Foggy vision	22	38	60	36.36
0.125% 54-2	115	25	140	82.10
Causticity Solution	98	27	175	78.04
Eye Qigong Exercise	175	24	199	87.94
Total	410	114	524	78.24

From Table 3, we see that the curative effects of the eye exercise were the greatest in the Qigong group.

## II. Study of the Principles of Eye Exercises

As we observed the clinical effects, we also observed the blood stream, eye socket skin temperature, eye sockets, and cerebral blood flow before and after the Qigong eye exercise from students of different ages chosen from college, high school and elementary school in order to study the mechanism of the eye.

### 1. Testing blood flow in the brain.

(1) Equipment and Method. J x 74A bridge type blood stream imaging machine connected to the lead-I electro-cardiograph machine. Standard resistance was 0.1. The forehead-breast lead was used. The sitting position was required for all tests.

(2) Testing results. 74 blood flow images were taken from students of different age groups in college, high school, and elementary school before and after Qigong practice. The main indices observed were the amplitude of the blood flow images and the variations in amplitude from both sides (see Table 4).

Table 4  
Amplitude of Blood Flow Images in the Brain and Variations  
in Amplitude in Both Sides

	No. of Cases	Mean Value of Amplitudes		p Value	Mean Difference of Amplitudes		p Value
		Before Qigong	功后		Before Qigong	After Qigong	
Ele. School	58	0.194	0.236	<0.05	18.56	12.11	<0.05
Middle School	72	0.166	0.188	<0.05	19.61	16.61	>0.05
College	18	0.157	0.107	>0.05	20.30	9.56	>0.05

From Table 5 we see that there were increases in amplitude of blood flow in the brain after the Qigong exercise (see Figure 9). They increased progressively in the order of college to high school to elementary school students. The amplitude variations of both sides however, decreased progressively which corresponded to the clinical results (see Figure 10).

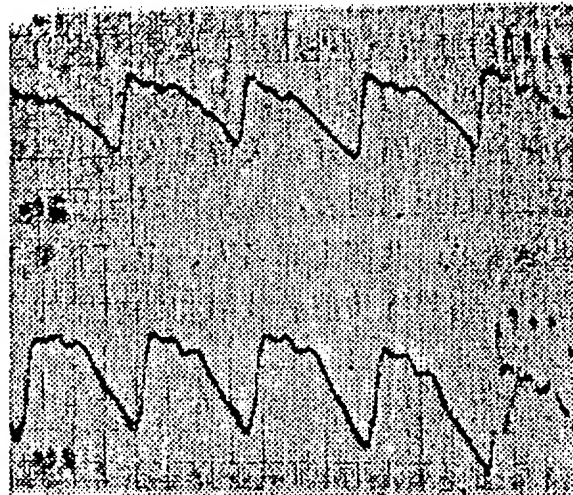


Figure 9. Sample of Variations in Blood Flow in the Brain (Zhang Ligang, male, age 12).

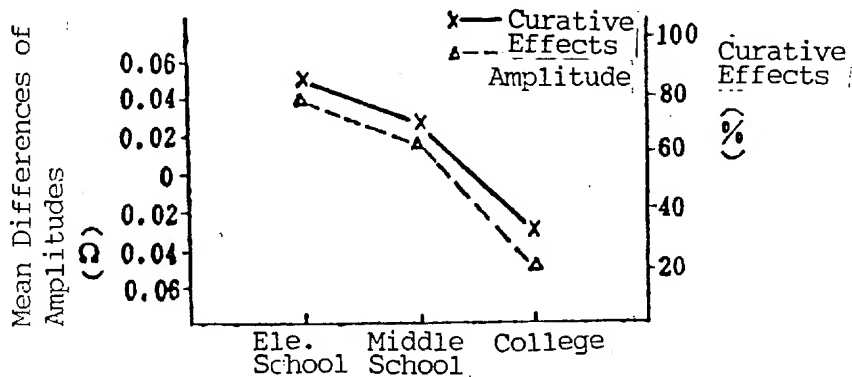


Figure 10. Relationship between the amplitudes of brain blood flow images and curative effects.

## 2. Test of Blood Stream Images of the Eye Socket Area.

(1) Equipment and methods. Equipment used included the same as in the brain blood flow image test, except that the eye-ear connection was used (placing eye cover electrode on eye lashes as a positive charge and placing silver lead on the external auditory meatus of the ear as the negative charge and completing the circuit with a spring). The key to the experiment was to let the head muscles relax with both eyes looking forward, then close the eyes and relax for an additional five minutes.

(2) Test results. Blood stream images of the eye socket area were taken from 46 students from colleges, high schools, and elementary schools. Amplitudes and amplitude

variations before and after the Qigong exercises and curative effects were compared (see Table 5, Figure 11).

Table 5  
Variations in Amplitudes in Blood Flow Images from the Eye Socket Area and Amplitude Differences

	No. of Cases	Amplitudes ( $\Omega$ )			Differences of Amplitudes (%)		
		Mean Value Before Qigong	Mean Value After Qigong	Mean Differences Before and After Qigong	Mean Value Before Qigong	Mean Value After Qigong	Mean Differences Before and After Qigong
Ele. School	24	0.297	0.327	0.030	23.83	16.60	7.23
Middle School	12	0.261	0.281	0.020	22.00	13.91	8.09
College	10	0.321	0.322	0.001	23.40	14.27	9.03

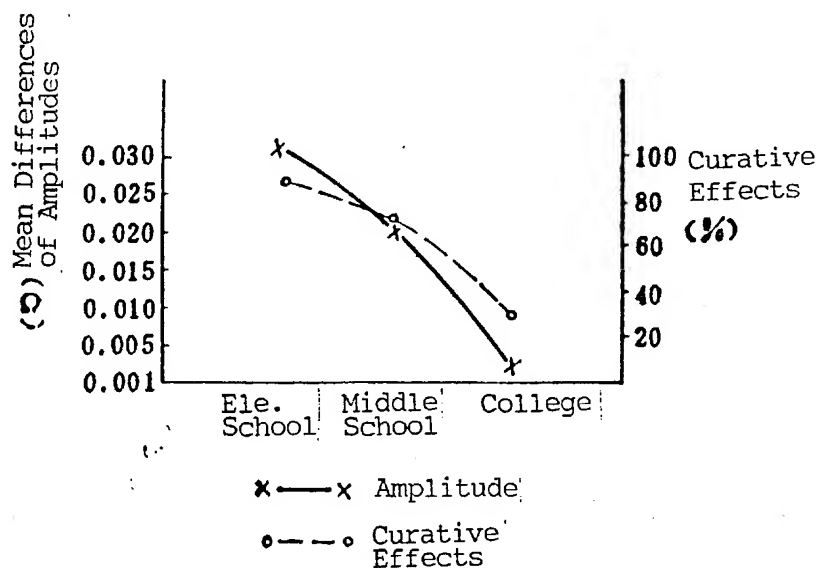


Figure 11

Comparison between the Amplitude of blood flow pictures and the curative effects before and after Eye Qigong

After comparing amplitude changes of the blood stream figures before and after the Qigong eye exercise and the clinical, curative effects, we found that the elementary school group which had the best curative effects had the largest increases in amplitude. There were however, no remarkable amplitude increases in the college group which had the least response to Qigong's curative effects.

3. Test of skin temperatures in the eye socket area. A semiconductor point thermograph was used to test the eye socket area skin temperature before and after the Qigong eye exercise. Testing points were "Jingming" points on both the left and right sides. Temperatures at the testing points and that of the room were the same. To prevent errors caused by varying pressures from contact of the head of the

point thermograph and skin, subjects were required to sit and tilt the head backwards 30 degrees. The head of the thermograph was vertical to the Jingming points. The average values taken from the measurements were observed three times before Qi and three times after. It was found from the results that the temperatures from all age groups increased after the Qigong exercise which was significant ( $p < 0.01$ ). See Table 6.

Table 6  
Comparison of Skin Temperature Around Eye Socket  
Areas Before and After Eye Qigong Exercise

Groups	No. of Sub-jects	Mean Temper. Before Qigong	Mean Temper. After Qigong	Mean Tem. Before & After Qigong	t Value	p Value
Ele. School	42	28.28	30.23	1.95	13.45	$< 0.001$
Middle School	22	28.04	30.05	2.01	9.52	$< 0.001$
College	26	28.38	29.81	1.43	4.55	$< 0.01$

4. Results of the far-near point hearing test. This was a test of the index of the eye's ability to adjust. 98 near-sighted eyes were tested by a far-near ruler. Before the Qigong exercise, the near point was 7.3 cm in the elementary school group, which was about 1.7 cm closer than the normal eyesight of students of the same age. The near point of this group after Qigong was 8.3 cm ( $p < 0.05$ ) which was not remarkably different. The far point however, in this group before Qigong practice was 50.7 cm and 59.9 cm after ( $p < 0.05$ ). There was an obvious difference. In the college group, the p values before and after the Qigong exercise were all greater than 0.05, so there was no obvious change.

5. [A fei Mo Fu--transliteration of Chinese term] Chart Test. This is an index for measuring the extent of fatigue and recovery ability of the brain and eyes. Subjects were asked to draw the assigned symbols from 400 symbols. The time and number of correct symbols after checking the 400 symbols were recorded, then accuracy was calculated which eliminated errors caused by counting varying rates of assigned symbols in each row in the traditional method. 32 students from different age groups were tested with the Afimorph chart before and after the Qigong eye exercise. Results are listed in Table 7.

The average variations in time of the [A fei Mo Fu--transliteration of Chinese term] chart from college, middle, and elementary school students before and after the Qigong



exercise were compared with the curative effects of the Qigong exercise. It was found that they were surprisingly coincident, which indicates that the younger the subject, the least responsive he is to Qigong's curative effects. The average time variations of the [A fei Mo Fu--transliteration of Chinese term] chart before and after the Qigong exercise also increased progressively; 5.0 seconds for the college group, 17.0 seconds for the middle school group and 33.6 seconds for the elementary school group. The relationships between these calculations are shown in Figure 12.

Table 7  
Results of Afeimofu Chart Tests from All Groups

Groups	No. of Subjects	Average Time (Second)		Time Differences Before & After (Second)	t Value	p Value
		Before Qigong	After Qigong			
College	10	109.0	104.0	5.0	1.51	$>0.05$
Middle School	10	166.0	149.0	17.0	2.50	$<0.05$
Ele. School	12	201.6	168.0	33.6	6.42	$<0.01$

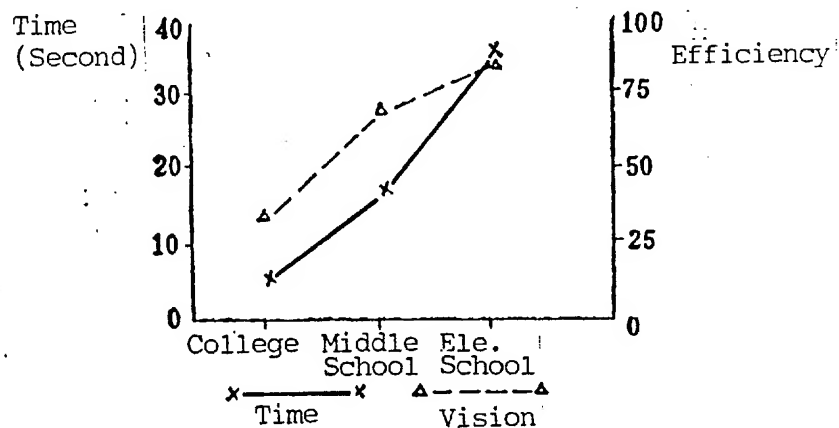


Figure 12. Comparison between the Afeimofu chart test results and curative effects.

### III. Synthetic Analysis

This study analyzes the curative effects of the Qigong eye exercise from different age groups from college, middle school, and elementary school. Total efficiency was 75.6%. The curative effects of each group are as follows: College - 33.33%, middle school - 71.4%, elementary school - 82.26%.

The curative effects of the Qigong eye exercise group were compared with the vision impaired group, the 654-2 eye drop group, and the causticity solution group. Results show that the Qigong eye exercise group had the most positive curative effects. Therefore, we conclude that the Qigong eye exercise is a good method to prevent and cure vision degeneration among youth. This method is a combination of Dong and Jing movements, which are easy methods suitable for popularization in middle and elementary school.

Five biological index tests were conducted before and after the Qigong eye exercise on five people. All results obtained show remarkable changes especially in the relationship between elementary, middle school, and college student's responses to curative effects which was surprisingly coincident with the clinical, curative effects. Figure 13 illustrates the three-dimensional relationship between the results of eye socket skin temperature, blood stream amplitude changes, and clinical effects.

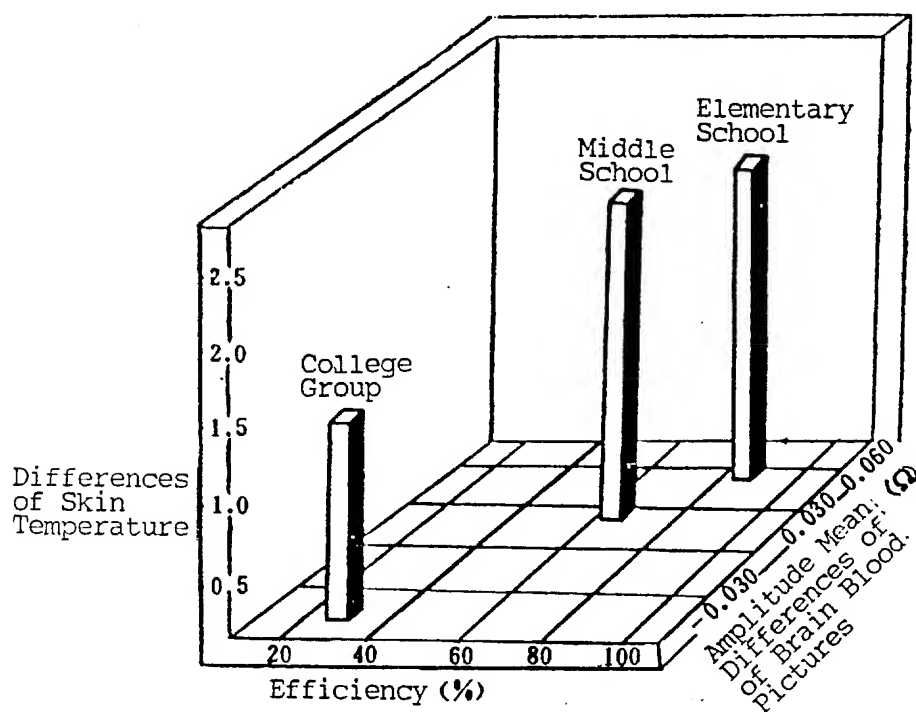


Figure 13. Relationship between results of the eye socket skin temperature, blood stream amplitude changes, and clinical effects.

Amplitudes of the eye socket area and the blood flow images of the brain all increased after the Qigong eye exercise. Skin temperature at Jingming points also rose which indicates that this Qigong exercise had effects on changing blood circulation in the head. The Qigong eye exercise is used mainly to affect biological variations in the eye area with external Qi from the Laogong point. Modern science holds that "Qi" is the sum of energy, substance, and infor-

mation. If Qigong practitioners use it at a certain point, amplitudes of the blood stream image will increase. This indicates that Qi is the reflection of blood energy and blood is the substantial basis of Qi.[3] As for the method of improving blood circulation in the brain and eye socket area by the Qigong eye exercise, our conjecture was that it may function through the autonomic nervous system. Since the blood vessels to the brain originate from the carotid artery and vertebra artery, the blood vessels in the eye socket area come from the eye artery which branches from the jugular vein. These blood vessels all have connections to the sympathetic and para-sympathetic nervous fibers. Even though the volume of the cranial cavity is relatively fixed, it is impossible for the brain's blood vessels to expand and contract to a great extent. Decreases in the amplitude of the brain and eye socket area on both sides however, reflect that the blood supply situation from both cerebral hemispheres tend to be balanced and adjusted by the cerebral center, particularly the autonomic central nerves.[4,5]

After the Qigong eye exercise, the distances of the near and far points were both greater, especially the far point which increased the adjustment range. A feature of myopia is that the near and far points all move closer. This reduces the eye adjustment ranges and makes parallel light rays form images in front of the retina. The Qigong eye exercise is favorable to corrections of myopia because it enables the far point to increase in distance. Our study indicates that the younger the age, the better the effects.

How can the Qigong eye exercise correct myopia by moving the far point farther away? According to the theory of dual control of eye muscles by sympathetic and para-sympathetic nervous systems, there are two explanations for the crystal adjustment.[6,7] One is relaxation and the other is tensity.[8] The relaxation explanation holds that when the eye sees an object at a close distance, the parasympathetic nerve in the oculomotor nerves causes contractions of the muscle and relaxation of the suspensory ligament so the diopter increases. The sympathetic nerve causes the contraction of the ciliary radial fibers and the density of the ligament. The crystal becomes flat so the diopter decreases. According to the tensity explanation however, the more tense the suspensory ligament is, the harder the crystal is pressed, which forces the crystal to bulge against the cyst wall towards the pupil. The curvature also increases. The sympathetic nerve can increase the diopter to some extent. As a matter of fact, the sympathetic and parasympathetic nerves can have synergetic effects on many organs instead of always contracting.[9,10] We conclude that the Qigong eye exercise might retard the impulsion of the sympathetic and parasympathetic nerves that control the eyes. Since Qigong is a relaxed response, it reduces the tensity of the sympathetic nerve and should have reduced the activity of the parasympathetic nerve that was in a tense

state. Thus, it is able to relieve spasms of the ciliary muscles to some extent, move the near and far points and increase adjustment ranges.

In summary, we conclude that the Qigong eye exercise can improve blood circulation in the brain and eye socket, increase skin temperature in the eye socket area, and increase adjustment ranges. According to Mei Lei and Lin Yagu, in Qigong, the brain waves slow, the skin electricity is reduced, and the skin electricity on both sides tends to be synchronously balanced. This indicates that Qigong has a very close relationship with the adjustment of the autonomic nerves. That is to say, Qigong has an overall adjustment effect on the body. This adjustment or effect helps organs to be in a more normal biological process. Indices earlier described explain that the mechanism of this effect can be achieved through the adjustment and conformity of all levels of the central and autonomic nervous system.

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## Preliminary Study on Qigong and Immunity

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and Kuang Yueqin (Chinese Hospital of Jiangshu Province)

As a component part of traditional Chinese medicine, Qigong's history has been traced back several thousand years ago. It is considered a sport promoting health and national characteristics and has been an effective method to prevent and cure diseases for people in our country. The study of Qigong not only has use in protecting health and preventing disease, but also is a window to help us know life's phenomenon. In order to study the mechanism of Qigong treatment, to see if Qigong helps us to achieve the purposes of preventing and curing disease by adjusting the internal relative balance of organs and strengthening immunity, we tested the immunity system of healthy people as well as patients who had different types of tumors. They included Qigong practitioners and non-Qigong practitioners. Results are as follows:

### I. Subjects of Observation

Healthy people and tumor patients, some being Qigong practitioners and some not. Tumor diseases included cancer of the esophagus, stomach, lungs, liver, rectum, breast, etc.

### II. Items of Observation

Body fluid immunity: IgG, IgA and IgM in serum.  
Cellular immunity: White blood cells adhesive inhibition test (LAI), active E rose antigen test (EA), t-lymph cells test with a-acetate dye method (ANAE).

### III. Results of the Analysis

#### 1. Humeral Immunity Test

Thirty-six tumor patients were randomly tested. Three months before and three months after Qigong practice, the IgG, IgA, and IgM were tested. Among them, the most important was the IgG antibody which is the body's main antibody. It makes up about 75% of the serum. The results listed in Table 1 show that before Qigong practice, the IgG average value was 767.47 plus or minus 330.29 mg%. After Qigong practice it was 1193.4 plus or minus 323.9 mg% ( $p < 0.001$ ), which shows a remarkable difference. There was no variation in IgA and IgM values ( $p > 0.05$ ) before and after Qigong practice. The increase in the IgG amount indicates that the patient's immunity improved, which resulted in the body's ability to resist disease. It was favorable for the tumor patients in extending their length of survival.

Table 1  
Results of Humeral Immunity Test from 36 Patients Before and After Qigong Practice

Items Tested	Normal Mean Values of 30 Cases mg%	Mean Value Before Qigong mg%	Mean Value After Qigong mg%	p Value
IgG in Serum	1219.5±391.67	767.47±330.29	1193.4±323.9	$p < 0.001$
IgA in Serum	193±43.8	178.8±85.46	201.0±70.19	$p > 0.05$
IgM in Serum	123.6±65.37	108.86±46.02	100.8±38.84	$p > 0.05$

## 2. ANAE Test

Esterase in T-lymphocyte hydrolysis can hydrolyze a-acetic which then produces a-[chushuan Tu Fen--transliteration of Chinese term] and [Hong Eoulian--transliteration of Chinese term] which becomes the brown-red particles (by-product of heavy azodyes). According to these cell variations, T-lymphocyte numbers were calculated under microscope. We tested some healthy people and tumor patients, some who had and some who had not practiced Qigong (see Table 2).

Table 2  
Comparison of ANAE Test Results from Healthy People who had and had not practiced Qigong

Subjects Tested	No. of Cases	Mean Value of ANAE %	p Value
Qigong Practitioners	72	74.90±11.61	$p < 0.01$
Normal People	40	65.50±8.9	

From Table 2, we see that the ANAE values of Qigong practitioners were 74.9 plus or minus 11.61%, which obviously differed from the average values of healthy people who had not practiced Qigong ( $p < 0.01$ ).

In order to see if the cell immunity of tumor patients could be improved after Qigong practice, we randomly tested the ANAE values of 40 patients who had practiced Qigong and 40 who had not (see Table 3).

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Table 3  
Comparison of ANAE Test Results between Tumor Patients  
who had and Tumor Patients who had not Practiced

Subjects Tested	No. of Cases	Mean Value of ANAE %	p Val
Tumour Patients with Qigong	40	67.15±10.04	$p < 0.0$
Tumour Patients without Qigong	40	43.4±12.46	

Table 3 illustrates that there was a remarkable difference between the results of the ANAE test of tumor patients who had practiced Qigong and those who had not ( $p < 0.01$ ).

3. Adhesion and Inhibition Test of White Blood Cel.  
LAI is a test by

LAI is a test based on the adhesive ability of white cells from peripheral blood on clean slides under different conditions. Adhesion decreases under relative antitumor and inhibition situation. This phenomenon is a sensitive reaction induced by additional antigens. It is a valuable index for observing states of illness and judging prognoses. For those patients whose condition improved, the LAI decreases but increases when a patient's condition worsens. We gave LAI tests to 26 tumor patients before and after they had practiced Qigong (see Table 1).

Table 4  
Comparison of LAI Test Results of 26 Tumor Patients  
and After Qigong Practice

Test Item	Normal Mean Value of 30 Cases %	Mean Value Before Qigong %	Mean Value After Qigong %	p Val
LAI	42.8±7.84	72.57±9.37	52.1±8.25	<0.01

Table 4 illustrates that LAI average value before practice was 72.57 plus or minus 9.37%. After Qigong adjusted to 52.16 plus or minus 8.25%. There was a remarkable difference before and after ( $p < 0.01$ ).



#### 4. E antigen Garland Test

We gave the Ea Garland test randomly to 26 tumor patients. Results are shown in Table 5.

Table 5  
Comparison of Ea Garland Test Results of 26 Tumor Patients  
Before and After Qigong Practice

Test Item	Normal Mean Value of 30 Cases %	Cell Average Value Before Qigong %	Cell Average Value after Qigong %	p Value
Ea Garlands	$28 \pm 3.64$	$24.07 \pm 3.89$	$29.66 \pm 4.02$	$p < 0.001$

Ea Garlands are in effect, cells in T cells that have immunity characteristics. Our results show that before Qigong practice the Ea Garland average value was 24.07 plus or minus 3.89% (lower than normal). After Qigong practice it increased to 29.66 plus or minus 4.02% (normal). There was an obvious change before and after Qigong ( $p < 0.001$ ).

Tested indices above indicate that Qigong can strengthen humeral cell immunity. Our study also shows that after patients practiced Qigong, their appetite improved and they had more vitality. They were also able to gain weight. Qigong has improved the quality of life, relieved the symptoms, and prolonged life.

#### Summary

It was said in "Nei Jing" that if vital energy stays in the body then evil factors cannot disturb. "Where there are evil elements, vital energy is weak." It expounded the law of the causes of disease. In normal situations, vital energy can resist external evil factors or eliminate them by adjusting the balance of Ying Yang and internal organs which shows that functions of vital energy are very similar to the immune system. Qigong practice can culture true Qi and bring exuberant vital energy, stimulate the functions of internal organs, and improve organic disease resistance, so purposes of prevention and elimination of disease can be achieved. We have used many kinds of experimental methods to study the relationship between Qigong and immunity. This article discusses the testing of cell immunity and humeral immunity on healthy people and tumor patients including Qigong and non-Qigong practitioners in both groups. By comparing test results, we found that there were remarkable differences, which indicates that cell immunity and humeral immunity improved after Qigong practice. However, this was merely our primary study. Qigong is a precious cultural

heritage of China. As its descendants, we should take the responsibility to excavate and systematize Qigong theories by discarding dross and selecting the essential, eliminating the false and retaining true contributions to modern science and our nation.

## Chinese Qigong and Synergetics

Li Fuli (Physics Department of the University of Science and Technology of China)

Chinese Qigong is both old and new. It is not only popular but also mystic. It has both practical and scientific value. There are names for every type of Qigong, but many seem to lack basic theories. These characteristics indicate that Chinese Qigong is very important and a research area that can result in breakthroughs.

In recent years, there have been two main developments in Chinese Qigong research. One is the study of the relationship between Qigong and brain activity and the study of the effects of external Qi of Qigong by Gu Hanshen and Mei Lei, et.al. The other is the concept of the state of Qigong as a function proposed and discussed by Qian Xueshen and He Chongyi.[1] This article will discuss Qigong synergetics based on the above studies and the development of synergetics and brain science abroad. The article will first mention the concept of synergetics originated in China, then it will give the meaning and definition of Qigong according to synergetics. It will emphasize the analysis of relationships between Qigong and related infrasonics, Qigong and the electroencephalogram, thoughts and their characteristics. At the end, it will give conjectures and predictions on several new effects based on the Qigong synergetic concept. Also, it will give suggestions as to the development and some experiments of quantitative Qigong science.

### I. Concept of Synergetics Originating from Ancient Chinese Qigong

Synergetics studies the relationship between entirety and individuality, and the systematic and macroscopic properties manifested by the cultural effects and cooperation of individuals. Modern synergetic theory was developed on the basis of laser theories after the laser was invented. However, rich and profound synergetic ideas had been included in ancient Chinese philosophy, medicine and Qigong theories. Synergetics actually originated from Chinese Qigong.

It is known that synergetics derives from synergism which is formed by two greek words. Its original meaning was "cooperate" or "work cooperatively." The word "synergetics" was created by Sherrington.(2) About one hundred years ago, while studying muscles, he found that muscles had properties of coordination and consistency (synergism of muscles). Surprisingly, the ancient Chinese scientists had studied the same objects and found the same law several thousand years ago. They used an almost identical name. In the "Shuwenpian" (Shuwen chapter) of Huang Di Nei Jing, it men-

tions breathin, Jing Qi. Concentration and muscle coordination may be the earliest synergetic concept recorded in written language. It also discusses the concept of synergetics by studying the characteristics of muscles. "To breath Jing Qi and concentrate thoughts" are the main points of Qigong practice. "Muscles coordinating as a whole" is the characteristic and effect of Qigong, which can be comprehended as the coordination of different muscles or different parts of muscle functions. This is consistent with the meaning of "synergism of muscles." Therefore, we conclude that the earliest concept of synergetics and its name come from ancient Qigong theory. This fact itself indicates that it may be valuable to study Chinese Qigong along with modern synergetic theory. It may also be an important way of revealing the profound mystery of Qigong by employing modern technology to study the relationship between Qigong and muscle movement, especially muscle sounds.

On the other hand, the word "thoughts" in "concentrating the thoughts" in Chinese medicine has a similar meaning to "cerebral activities." The description "to breath Jing Qi and concentrate the thought, muscles thus coordinate as a whole" also reveals the connection between brain activity and the Qigong mechanism. Therefore, it is very important to combine these factors on brain science abroad with the experience in Chinese Qigong and experiments in studying Qigong mechanisms.

The synergetic influence in Chinese medicine and Qigong theory are rich and profound. There are certainly more descriptions than the one described earlier. For instance, "Integrating nature and men," "Ying Yang theory of five elements," "four methods of diagnosis and eight principle notions of differentiating and classifying symptoms and signs," "ascertaining the causes of a disease and giving treatments," "the theory of internal organs," and "the theory of channels and collaterals." All of these contain synergetics and dissipation structure theories.

## II. Principles and Applications of Modern Synergetics

Research areas of modern synergetics are very broad. There are however, only two basic principles.[2] It is easy to explain the two basic principles using the laser.

### 1. The first principle of synergetics: Description of order parameter.

It is well known that ordinary light from a light source is spontaneous radiation. Spontaneous radiation can be described as a sheet of loose sand which is in a state of chaos. That is to say that spontaneous radiation is orderless. Laser beams are simulated radiation in that its order is fixed, an orderly stream of light.

When the pumping efficiency of a laser is lower than its threshold, then its radiation is spontaneous. Only when the pumping efficiency is higher than its threshold will the radiation become laser beams. Pumping efficiency is called the external control parameter of the laser system. When this controlling parameter is adjusted, the laser changes its threshold (critical point) from orderless to orderly. The working substance of a laser contains numerous active atoms. The laser is an open system far beyond equilibrium. Active atoms (simplified atoms) are a subsystem. If there are  $10^{20}$  atoms, each has three coordinates and its own velocity. To describe the conduct of  $10^3$  atoms, then  $6 \times 10^{20}$  variables and equations (non-linear) are needed. It is impossible to find the solution for  $6 \times 10^{20}$  variables of the equation. But in laser theory, only three variables (light field  $E$ , polarization intensity  $p$  and anti-particle numbers  $D$ ) and three equations are needed to describe the conduct of the laser. Under similar conditions, these three equations can become one equation, that is, the light field equation. The analytic solution can even be obtained. In synergetic theory, the light field  $E$  is called the "order parameter" of the laser.

"Order parameter" is a concept first used by the Russian theoretical physicist Landau to describe phase changes in equilibrium. The founder of synergetics, Haken, used it to describe phase changes far beyond equilibrium. He also found that the form of non-equilibrium and equilibrium are similar. Order parameter is an important concept in synergetics. The first principle of synergetics is that "the conduct of the system at the critical point can be described by the order parameter." In other words, the order parameter can describe the entire conduct of the system and sudden changes of its conduct at the critical point.

2. The second principle of synergetics: Master molds and slave molds.

According to laser theory, when the laser is working, there are many oscillations qualifying the laser's condition. In other words, laser beams contain all of these frequencies. Actually, laser beams contain few, perhaps only one frequency. A frequency is called a "mold." Because of the competition and natural selection among all molds, only one or a few molds (master molds) dominate. All others are eliminated and restrained. They are called "slave molds."

Generally, a mold can be considered as a way to describe the whole conduct of the system. The second principle of synergetics is "among the many molds in the system, only one or a few can be in a dominant or controlling position (master mold) while all others will be restrained and eliminated."

The basic idea of this second principle is very similar to "democratic centralism." In other words, a group is a system. All members in the group are subsystems. A resolution is the order parameter, and the half number of the group members is from the cooperation and competition among group members. It is decided only when more than half of the group members participate. As soon as the resolution is decided, all members submit the resolution. The resolution then dominates and controls the group members. A new resolution will be revised or passed if the condition changes.

### 3. The application of synergetics.

Synergetics reveals the general law of development and evolution of self-organizing formations of complicated systems in different subjects. Its main achievements can be summarized as follows:

(1) A system that is far beyond equilibrium has similar conduct as in equilibrium. For instance, laser is a system that is far beyond equilibrium. The transformation of the laser from orderless to orderly is a secondary phase which changes the non-equilibrium. The bi-equilibrium state in optics is the primary phase change of the non-equilibrium state.

(2) The non-linear system of non-equilibrium has complicated the conduct of time: A. stationary state output that is unrelated. B. Self pulse (pulse caused by internal effects not by external adjustment). C. Periodicity or rhythmicity. D. Doubling of periodic output. E. Chaos.

It should be pointed out particularly that chaos is an irregular conduct of time. It is the intrinsic property of a system. It is not caused by undulation, nor the high degree of freedom in a system. Chaos signals can not be expressed by the addition of many repealed sine waves. It is also different from noise. The power spectrums of the chaos signals are continuous in low frequencies. There is also abundant information in chaos signals.

(3) Synergetics has been applied to physics, chemistry, bioecology, biology, morphology, brain science, economics, social science, and even psychology yet synergetics has its limitations.

### III. Brain Synergetics

The brain contains about  $10^{10}$  neurons. It is felt that the functions of the brain are based on the coordinate conduct of subsystems (neurons) which are described as follows:

(1) The chaotic state of the brain.

The latest research abroad indicates that the electroencephalogram of a healthy person shows chaotic signals. Its power spectrum is continuous at low frequency ranges. The EEG shows strange conduct. This indicates that the relative differences are fractal.

(2) The relative orderliness of a morbid brain.

It was found from experiments that the EEG of an epilepsy patient is quite regular (more orderly than normal). Therefore, we suggest that Qigong can make the EEG appear to be orderly. It does not seem proper to say that the higher the order, the better.

(3) Spontaneous order of the brain without stimulation.

West German scientist Baser thinks that the spontaneous orderly state of the brain is caused by a "hidden source." We feel that it is caused by thoughts. He also found that the stronger the spontaneous order of electrical activity in the brain, the less orderly are the increases stimulated by external factors. This, we feel, has something to do with the mechanism of Chinese Qigong.

(4) The coherent state of the brain.

West German scientist Baser advanced the concept of the coherent state of the brain by studying evoked potential. If testing the EEG of an animal or person immediately after stimulated by sound or light, it was found that the order of the EEG increased (EP potential). The length of this state of order only lasts 35 milliseconds. Baser, therefore called the state corresponding to the EP potential the coherent state (compared with the relative state).

(5) The squeezed state of the brain.[3,4]

In order to explain Qigong and Psi, we posed the assumption of the "squeezed state of the brain" which is similar to the squeezed state of light. The squeezed state of the brain can breakthrough the quantum limit of noise giving it super-sensitive testing ability.

Some Qigong effects may relate to the coherent state of the brain. Some Psi (exceptional ability of recognition or remote sensing) may also have something to do with the squeezed state of the brain.

#### IV. The Qigong Synergetic Concept

To study a complicated system with synergetic theory, we should first define what the control parameter, order parameter, mold, and critical point are.

1. Thoughts are the control parameter of the human body.

Thoughts are produced by the brain. They are also the control parameter of the brain. Thoughts act as control parameter to the body as well. Stimulants, acupuncture, medicine, and exercise are all external control parameters. Thoughts are internal control parameters. As control parameters, thoughts can lead the body into different functioning states including a person's thoughts controlling another person's functions.

Thoughts, as internal parameters exist inside the system. Baser holds that the spontaneous orderly electrical activities of the brain are caused by a "hidden source." Moreover, it was found that the feedback loop between functions and formations required a "third factor." The function's recovery from formation damage was not only due to the regeneration of nerve cells, but also needed an unknown mechanism. It is our view that Qigong theory and practice have indicated that thoughts may be the "hidden source" or the third factor affecting recovery. The practice of curing disease by thought also indicates that thoughts have important effects on the feedback loop of functions and formations.

2. Qi (vitality and vital energy) order parameters.

According to the first principle of synergetics, the conduct of a system at the critical point can be described by order parameters. Actually, Chinese medicine and Qigong theories are using an order parameter, that is Qi, which describes the human body macroscopically.

Research of synergetics indicates that many different non-linear systems can be described by similar non-linear equations especially in the chaos theory. universal constants (unrelated to the equation forms) provide possibilities for studying Qigong dynamics and quantitative Qigong theory.

Qi is the basis of life activity and health and can maintain relations between body functions and the outside world. The conduits of Qi in the body are channels and collaterals. Channels and collaterals are self-organized, non-equilibrium formations. Qi possibly travels in channels and collaterals as an isolated subsystem.[3]

Qi becomes external Qi when it is emitted from the body. For Yindong gong (guiding gong) and Qigong treatments, external Qi becomes the external control parameter of the body. This is similar to a laser that has input signals or use the output of the laser to power another laser.



3. Qigong molds.

Different forms of space and time of Qi (vitality or vital energy) can be defined as the molds of Qi. In a non-Qigong state, Qi disperses many molds which are incoherent to each other. In Qigong, only a few molds can be in leading positions.

4. Coherent state or super-radiation state of the body.

When the internal control parameters (thoughts) and external control parameters reach a critical point, the body can enter a coherent or super-radiation state (a term of laser physics). In this state, Qi in the human body produces synthetic coherent energy with different forms and characteristics - coherent infrasonics, coherent light (laser), and coherent microwaves (similar to maser with its different formations in different levels). In other words, Qi is a synthetic coherent energy similar to the laser, produced by life activities.

Therefore, different kinds of Qigong can have different external Qi effects. There can also be different or similar effects from different types of Qigong.

5. When control parameters of the body reach a critical point, then the body can enter an exceptional functioning state such as in a squeezed state. We hope that our definitions of the control parameters of the body, the orderly parameter, mold, critical point, and other definitions can be helpful to international academics to explain or predict certain phenomenon or even help quantitative Qigong science initiate Qigong dynamics.

V. Qi and Coherent Infrasonic or Coherent Muscle Sounds.

The synergetic concept of Qigong masters studying muscle conduct has been discussed earlier. Experience and practice indicates that at least some Qigong styles can produce coherent infrasonic or coherent muscle sounds which may also involve the transduction of channels and collaterals.

It is known that muscles can produce sounds when they contract. The frequency of human muscle sound is 25 Hz. Muscle sound is infrasonic. Infrasonics have been measured from Qigong masters in our country. Infrasonic equipment has also been made which has effects on certain diseases. Moreover, it was found that when the famous martial art and Qigong specialist Hou Shuying was performing Qigong, the infrasonic frequency from him was 70 times stronger than a normal person. It has also been reported by Wang Delei that low frequency machine waves and infrasonics were found in channels and collaterals.

$$I=n^2I_0 \quad [1]$$

To explain these phenomenon, we raised the vibrator mold muscle fibers. Each muscle fiber vibrator vibrates in a certain frequency. If the phases of these vibrators are in chaos, then the muscle sound is weak. If the phases are identical, then the intensity of each muscle fiber's infrasonic structure is  $I_0$  and the muscle intensity is  $I=n^2I_0$  which can be used to add up all the identical phases from vibration of each subsystem.  $I_0$  can also represent the light waves and microwaves from each single vibrator. Because this formula is similar to Einstein's  $E=mc^2$ , it is understandable that Indian Qigong specialists claim to have found the same plan of transformation of energy as Einstein.

When the body is in a non-Qigong state, the phases of muscle fibers are in chaos, with only a few being identical. The muscle sound is weak. When the human body is in a coherent state, the phases are identical and the muscle is much stronger. The frequencies of each may not be the same but when the phases in a coherent state are fixed, the energy can still be calculated by the formula. If all or part of the body's muscle fibers vibrate in some phases, then the intensity of coherent infrasonics is surprisingly high.

There is a relationship between the power of muscle sound and muscle contraction and its function. The synchronism or fixed mold of muscle sound requires the corresponding synchronism of the biological process and ATP energy releasing process related to the contraction of muscle fibers. The synchronism of these processes are under the conditions of the synchronism of the nerve system. Coherent infrasonic sound may be a kind of energy from the coherent state of the body.

Here are two typical examples of hard Qigong: It is known that the famous hard Qigong specialist Hon Shuying from Beijing can break a 16cm thick stone plate with his head. He was measured by an infrasonic sound receiver and found to have muscle sound 28 times stronger during the Qigong performance than when he was not in a Qigong state, which was 70 times higher than that of a normal person in a state of Qigong. In other words, the synchronic number of his muscle fibers was  $\sqrt{70}$  (approximately 8 times higher than a normal person). This indicates that Qigong can lead the muscle contraction towards orderliness producing coherent infrasonic sound or fixed infrasonic sound.

The production of coherent infrasonic sound by Qigong has importance. First, it indicates that the body tends to be in a coherent state. Second, the infrasonic sound from equipment that imitates a Qigong master can cure disease. Third, infrasonic sound from hard Qigong may have powerful damage control effects which may be used in simulated experiments for infrasonic weapons. The frequencies, phases,

coherences, power, and other effects of infrasonic sound from a Qigong master should be measured.

Another example is the famous "Erzi Chan" (two-figured Dhyana) of martial art master Haideng. His gongfu certainly needs a very high level of energy. If two fingers of a regular person can support 2 kilograms and Master Haideng's weight is 50 kilograms, then the ratio of the weight supported is

$$r = 50/2 = 25.$$

From the first formula we know that if only the number of the coherent muscle fibers is  $\sqrt{25} = 5$ , then the mechanism of the "two finger Dhyana" can be explained.

Therefore, even though the above two examples are amazing, the number of coherent muscle fibers of the two masters may only be 5 - 8 times higher than a normal person's. Likewise, the  $n^2$  relationship in the first formula explains such performances as pricking the throat with a spear and rolling a car over the body.

In order to further study infrasonic sound from Qigong masters, we need to study brain waves and processes of releasing energy by ATP.

## VI. Qigong and Brain Waves.

It has been discussed earlier that without external stimulation, the brain can spontaneously produce orderly electrical activities which indicates that there is a hidden source or internal control parameter. Baser felt that this internal source is an unknown hidden source. The experience and practice of Qigong of several thousand years indicates that Qi can be produced only with thoughts and Qigong movements without external stimulation. We concluded that the unknown "hidden source" is the thoughts that are well known by Qigong practitioners. Yet when Qigong is not being practiced, thoughts are scattered and unordered. The orderliness of brain waves is therefore weak.

Baser states that external stimulation is a control parameter, yet that is the external control parameter. Thoughts are the internal control parameter which is different from external stimulation.

The time of orderliness of brain waves caused by external stimulation can only last 35 milliseconds. Yet the time of orderliness of brain waves caused by Qigong can last quite a long time (several hours). This is an important distinction. It also indicates that the coherent time is also different.

Baser pointed out that the stronger the orderly electrical activities, the smaller the effects from external stimulation. Therefore, when a Qigong master is in a coherent state, there is none or little effect from external stimulation. According to synergetic theory, this means the master mold restrains and eliminates those molds that correspond to external stimulation.

It should be pointed out particularly that senior Qigong masters or those who have Psi can enter a squeezed state which makes it possible for super-sensitive testing ability (such as perspective ability, remote sensing, and the ability to know what other people are thinking, etc.). It is possible to be connected with another body or brain. It should be an important task for science to study and develop the concept of the "squeezed brain state."

#### VII. Acupuncture and Synergetics

The induced electric potential experiment conducted by Baser was inspiring for understanding acupuncture treatments and acupuncture analgesia. Acupuncture is an external stimulation which is similar to other external stimulations. It can also lead the body to orderliness. Obtaining Qi by acupuncture is a sign of achieving orderliness. Acupuncture however, is different from regular external stimulation. First, acupuncture stimulates acupoints. Secondly, acupuncture can lead to orderliness for a long period of time. This may be the mechanism of acupuncture treatment.

Likewise, when the Qi obtained by acupuncture dominates as an order parameter, there are almost no effects from other stimulation, which is the macroscopic mechanism of acupuncture analgesia. According to synergetic theory, responses from acupuncture become master molds. Responses from operational stimulation become slave molds which are being restrained or eliminated. Thus the brain can almost feel the operational stimulation.

#### VIII. Characteristics of Qi and Qi Dynamics

It was felt by our ancestors that all things on earth are formed by Qi. Qi is the basis of life. There is a close relationship between the origin of life and Qi.

As described above, we concluded from experimental results that Qigong leads the body into a coherent state. The complicated system of the body in its different formations and levels, can produce different kinds of coherent energy such as coherent infrasonic sound, coherent light (biological light) and coherent microwaves, etc., which cause different kinds of effects. This will be discussed in a different article.

According to the synergetic and disappative theories, channels and collaterals should be in equilibrium and self-organized patterns.[6-8]

In dissection, there are tube-like substances or passageways such as channels and collaterals. When a person dies, the Qi then disappears destroying the channels and collaterals. Some low resistance lines recorded from a dead body may just be slackening effects.

Qi in Qigong theory and Chinese medicine is very important in maintaining health. Qigong treatments and some experiments indicate the effects of Qi on the life process. In order to explain the mechanism of Qigong treatment and some exceptional functions, we also posed the super-photosynthesis of Qi and the assumption of producing oxygen and nitrogen fixation. That is, Qi can have a photosynthesis effect inside or outside the body and also fix nitrogen and even produce protein which is consistent with our view that Qi is a coherent energy synthesized from different forms of the body in a coherent state.

As to Qi dynamics, we have five equations (non-linear) from the theory of five elements. The resolutions calculated by computer indicated that Qi can have stable state output, pulsed style output, periodic output and chaos signals.

Since the body has many control parameters, and the control parameters change themselves, the amount of time Qi conducts is complicated. This is possible with different conditions.

Comparing Qi with the dynamic properties of brain waves, we posed three quantitative assumptions.[5,6] 1. Qi and brain electricity are both chaos signals. Their power spectrums are continuous at low frequency areas. 2. The relative dimensions of Qi  $D_2$  should be saturated when  $n=5$  (the five element theory). 3. Qi and brain electricity are mutually supplemental. The relative dimensions of brain electric waves  $D_2$  should also be saturated when  $n=5$ . There have been experiments indicating that laser beams, the brain, channels and collaterals all have characteristics of chaos and fraction dimensions.[9] Channels and collaterals may be the reflection of the brain functions which can cure many diseases and influence a person's life span.

Moreover, dynamic Qigong has these characteristics: 1. The threshold feature. The practice of Qigong or acupuncture needs to reach a certain level to obtain Qi. 2. The resonance feature. There can be a resonant effect between a Qigong master and a patient (infrasonic sound resonance and light resonance, etc.). If this is true, then the concept of "resonance treatment" should be considered. Different Qigong masters have different effects on different patients. Resonant conditions may change due to the changes inside the

body when a Qigong doctor treats the same patient. Also, because of resonance effects, a Qigong doctor can help dredge channels and collaterals for people and teach others the skills necessary in curing diseases. 3. Acupuncture is very similar to an isolated subsystem. Qi in acupuncture and Qigong is probably transformed as an isolated subsystem which may be related to the biological isolated subsystem [3] found in an experiment in Roman University.

The study of Chinese medicine, exceptional functions and Qigong theories with the synergetic theory is worthwhile. Of course, large amounts of study and research need to be done if development of Qigong is to become a breakthrough to our national and cultural rejuvenation. It will indeed be inspiring.

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A Trial of the Phenomenological Theory of Jing-Luo

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Summary of Contents. Based on the five publicly acknowledged Jing-Luo phenomena, this article submits that their essential quality is in the propagate lines of isolated waves in organisms. This article surmises that the Jing-Luo exists in lower order living things, even in some cell groups composed of only a few and proposes a Jing-Luo model of the simplest kind, with only two cells. To study the essence of Jing-Luo clearly, it proposes studying low order organisms, best those that have not yet formed circulatory and nervous systems. This article also explains some experiences in Qigong and traditional Chinese medicine. We feel that by using a number of methods such as mechanics, heat, electromagnetics, etc., we can trace the application of Qi in Jing-Luo.

One, Foreword

The Jing-Luo theory is an important component of traditional Chinese medicine and Qigong, guiding much of their application. When we establish the phenomenological theory of Chinese medicine and of Qigong, we start with the Jing-Luo theory, not only to conform to the requirements of the theoretical system, but also to be as objective as possible. The reason is that several thousand years of application and scientific study in recent times have amassed voluminous facts, some of which have now been publicly recognized. This article, at the call of Mr. Qian Xuesen who first advanced the phenomenological theory, is based on the five phenomena now recognized as fact and proposes that the essence of Jing-Luo lies in the propagation of an organism's isolated waves. We can call it the Jing-Luo Isolated Wave Theory, or simply Wave Movement Theory, and use our article's theory to explain the applied experiences in Chinese medicine and in Qigong. This article also makes some predictions based on these experiences, in particular that Jing-Luo resides in the lower orders of animals and plants even to the extent of a small number of organisms composed of only a few cells. This article proposes a very simple two-cell model to look the most fundamental characteristics of Jing-Luo and the Qigong state.

The task of setting up such a Jing-Luo Phenomenological Theory is very difficult. This article will only make a cursory test for the above objective and, while a number of facts can be explained, the majority cannot. Therefore, the



writer offers a sincere welcome to one and all to examine the premises, theories and predictions so as to sift out the untruths and point out the direction of the next test.

## Two, A Number of Recognized Facts and Their Inference

After several thousand years of applied traditional Chinese medical treatment and Qigong exercising as well as current scientific study, much Jing-Luo phenomena have been observed. Granted that different people regard things differently, but many recognized facts have been accumulated to form a basis for the phenomenological theory. Five such facts are listed below for analysis and deduction.

1. Illness can be treated by the traditional but imprecise method of sticking a needle into an acupuncture point or a finger to find the ailing spot. This has shown that the size of an acupuncture point and the horizontal width of a Jing-Mai<sup>1</sup> are rather sizable, at least a millimeter or higher. Therefore, Jing-Mai is a macro- rather than a microscopic phenomenon.

2. Jing-Mai's substance cannot be found through dissection, so it is common phenomenon shared by all cellular groups and has no direct connection with the division of cells. This was pointed out long ago in traditional Chinese medical theory which held that Jing-Mai, Luo-Mai and Sun-Mai formed together into a network called Jing-Mai spreading out everywhere in the body. No matter what organ or tissue, Jing-Mai exists there.

3. Studies by Zhu Zongxiang<sup>2</sup> and other comrades have proven that limbs separated from the body but still alive continue to show Jing-Luo. It can be seen from this that Jing-Luo is primarily locally induced and the central nervous system does not have a determining effect.

4. Jing-Luo is conducted directionally and rather slowly. While it shows evidence of electromagnetism, it differs from that of those that spread more rapidly.

5. Some who practice Qigong regularly know that the Qi in Jing-Luo moves both as a wave<sup>3</sup> and as a particle<sup>4</sup>, sometimes rippling as a wave<sup>3</sup>, sometimes flowing like a particle. According to newspapers, the conducting of Jing-Luo in the wave state was recently discerned by the China Institute for Nuclear Study, the Higher Physics Study Center of the China Science Institute and the Anhui Hospital of Chinese Medicine's Jing-Luo Study Center using nuclear probe techniques. The discovered conduction and speed were in consonance with the Jing-Luo theory.

## Three, A Deterministic Jing-Luo Phenomenological Theory

1. The largest Jing-Luo were called Jing-Mai, the next in size

According to the basic facts above, we are of the opinion that the essential quality of Jing-Luo is in the line of conduction in an organism that resembles an isolated wave. Naturally this wave is not a purely and simply mechanical one, but is physical (including mechanics, heat, electromagnetism, etc.) which melds with certain chemical phenomena into a consolidated wave. For the sake of concise narration later, we shall at least for now label this consolidated wave as a Jing-Qi wave. This Jing-Qi wave refers to one that travels along the Jing-Luo and to any other Qi that are mentioned in Chinese medicine or in Qigong. Thus Qi is the content of the wave, the wave is its external shape and Jing-luo is the route of its travel.

How does the isolated wave differ from most of the ordinary waves?

First, the most important difference is its dual wave-particle nature where others only ripple. Thus only this isolated wave may be used to explain how the experienced Qigong exerciser knows the dual nature of wave and particle.

Second, the more familiar waves form a series of successive and symmetrical peaks and valleys on a graph (see Figure 1). The isolated wave only has a peak and so is asymmetrical. Several isolated waves may appear at the same time (Figure 2). When the peaks are some distance from each other, each retains its original shape; when they close upon each other, they have a non-linear effect upon each other and the shape of the wave changes drastically as a result. If the shape of the Jing-Qi wave can be measured, then we can determine whether it is an isolated wave.

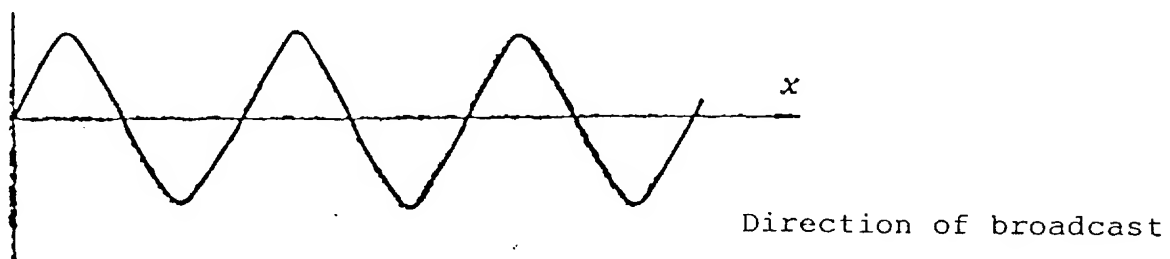


Figure 1. An Isolated Wave

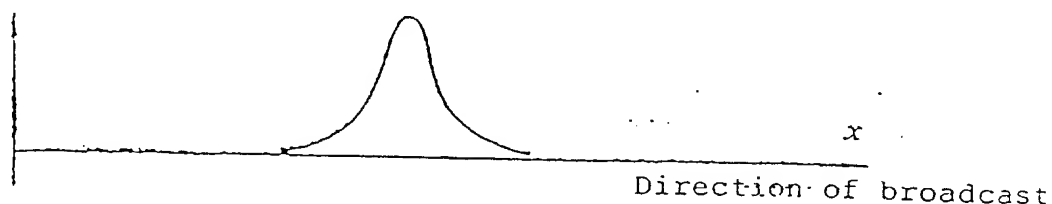


Figure 2. A Common Wave

Not only can the isolated wave theory of Jing-Luo be used to explain the facts in 5 above, but can satisfy those in the other four.

1. The isolated wave is a macroscopic phenomenon, the width of the peak can be wide or narrow. The bigger ones in the human body would probably not be very narrow and can probably be more than a millimeter.

2. Like the more familiar ones, the isolated wave leaves signs in the wave state but no traces otherwise. This can explain why Jing-Luo is not found in a dead organism.

3. Different waves are due to different causes. Those that are like Jing-Qi are very complex and sometimes hard to clarify. But most facts in physics show that once a certain kind of wave is produced, on what route it spreads, whether its intensity is strong or weak, maintains that intensity or increases depend upon the characteristics of the medium it uses. The Jing-Qi wave would no different, i.e., it also upon the medium. This deduction would jibe with the item 3 in the previous section.

4. Jing-Qi is a wave in motion directionally. In addition, it is a kind of wave consolidated from physical and chemical factors. It should be understandable that its speed is less than that of an electromagnetic wave.

#### Four, Experiences in Chinese Medicine and Qigong

The Jing-Luo theory of wave movement can be used to explain many experiences in traditional Chinese medicine and Qigong. Selected typical examples are listed below for analysis.

1. Qigan is the subjective sensation induced by pressure from the Qi wave.

In practicing Qigong or when acupuncture is used, there are aches, numbness, swelling, pain, cold, heat, etc. These are summarily termed "Qigan" or sensing Qi. What is its essential quality? Many people have guessed at it, but without conclusions. This article submits that Qigan is the sensation felt when a Qi wave meets an obstacle and thus pressure occurs. Any time a travelling wave encounters an obstacle, pressure arises. Waves beating against an embankment will evoke a water wave pressure. A great wave

can actually collapse an embankment. Sound and light waves produce pressure when they hit a roadblock. Generally, they are slight and measureable only with extremely precise instruments. Qi waves are no exception. Its pressure, using the axon of a nerve, causes a certain sensation. The stronger the pressure, the greater the sensation.

From this can be seen two prerequisites for Qigan: There must be a wave and there must be an obstacle. The lack of one would not produce Qigan. There are thus two kinds of people who do not feel Qigan. One is those whose Qi waves are weak and the other those whose Jing-Luo is passed through free and without hindrance. The experience of many people who practice Qigong supports this. Novices have weak waves and, while there is blockage, the pressure is very low and there is hardly any noticeable Qigong. At the intermediate level, the waves are stronger but the Jing-Luo is not yet passing freely in all places; a stronger pressure and a stronger Qigan occur. At this stage, it seems that sick people feel a Qi attack on their focal point of illness. Some have described this as Qi being a brilliant doctor attacking the illness wherever it occurs. Actually, Qi is ubiquitous but runs into the strongest obstacle at the point of sickness so the greater pressure evokes a greater sensation. When the Qigong exerciser reaches the highest level of advancement, there is ample Qi as a powerful wave but now Jing-Luo travels without hindrance so there is no pressure and thus no Qigan. There is only a sort of vacuum or void kind of feeling, of inaction. It is not without reason that those who exercise in Qigong regularly constantly remind people not to chase after Qigan. It is progress whether one goes from no Qigan to Qigan or vice versa. Chasing after it would bog people down at the intermediate level and stand in the way of progression to the higher level where there are no obstacles.

## 2. On the entry of Qi and saliva into the pubic area

Many of the Qigong exercises that emphasize calm breathing require that Qi enter the pubic area when doing so. Saliva secretion increases during Qigong exercise and such fluid is valuable. Almost all the exercises require swallowing saliva the some right time; some even require ingestion into the pubic area. Can Qi and fluid actually get there? And if not, what does? This has long been a subject for argument.

When we talk about Qi entering, we know that in the upper body, the nostrils opens to the lungs and air can be breathed in. But the lungs are closed off at the lower end so the air breathed in cannot get to the pubic area. So it has been concluded that it is not air, but Qi that enters. While this might have ended the question of the lungs being closed below, it brings on an even bigger question. If pure

Qi enters, then it must have been elsewhere first. But there is strong contention that pure Qi has always been in the pubic area. When exercising begins, Qi comes out of the pubic area and returns when exercising stops. This conforms the most closely to actual experience.

Now we come to the entry of saliva. Swallowed fluids and other foods first reach the stomach by way of the duodenum, the small and then the large intestine. Part of the intestinal tract lies in the pubic area; if there is no constraint by time, quite possibly the saliva would get there. But it takes a long time for fluid to go from the mouth down whereas fluids from exercising needs to get down there in a short time. It would not seem possible that swallowed saliva could get there in a short time.

We therefore surmise that Qi or saliva does not enter the pubic area as substance but as a wave. When ingesting food, the esophagus has a downward wave which loses shape at the stomach, but whose residual ripples would get to the pubic area. Lungs have a stretching and contracting vibration during breathing which makes waves in the lung cavity. This could reach the pubic area intact. What are called Qi or saliva actually are waves.

### 3. About the "Jing-Luo changing roads" phenomenon.

When histological matter in a human body is damaged or lacks something, it cannot be replaced by other matter. For example, after nerve cells are damaged, we cannot use other kinds of cells to transmit nervous signals. Or, for example, when a certain blood vessel is blocked, blood can flow through other vessels but not outside them. If a lone vessel passed through a certain matter, when blocked it stops functioning. The various illnesses from cerebral embolism are due to lack of blood in brain cells.

Wave movements are not all the same. If one is blocked, it would naturally make a detour; in physics, this is called "roundabout launching." It is hard to block a wave completely. The "roundabout launching" is what is called a "Jing-Luo detour." When the normal Jing-Luo stance runs into a roadblock, the Jingqi wave will go around. For example, many handicapped people have histological damage of varying degrees, yet Jing-Luo can still pass through. Some handicapped people who practice Qigong can reach the high level of free passage. The position of their Jing-Luo apparently is different from those of others, theirs changes routes.

### 4. Using resonance to evoke Jingqi waves

Massages used in traditional Chinese medicine have resulted in an important experience: pushing along with the

Jing-Luo nurtures, pushing against it dissipates. Forward should be slow, reverse fast. What is the theoretical basis? Looking at it from the Jing-Luo wave theory, Jing-Luo helps the forward ripples in increasing strength and attaining healing. The rate of the push should equal that of the Jing-Qi wave so as to create a resonance for greatest healing results. Since the Jingqi rate is slower when a person exercises the limbs, it is reasonable to slow down the speed of pushing. Of course, excessive slowness would retard the healing effect. Going against Jing-Luo is like sailing against the wind and would reduce the wave's momentum and attain dissipation.

While Jingqi is a wave phenomenon, then we can use the resonance methods of physics and engineering to evoke a wave or change its strength. Jingqi is the complex consolidation of physical, chemical and physiological phenomena into a wave. Search for the essence of Qi has proven difficult; but from the point of evoking Jingqi, it is a beneficial factor. The physics aspects of Jingqi indicates inclusion of mechanical, heat and electromagnetic phenomena. Then all of these can affect it. Traditional Chinese medicine and Qigong have jointly produced some simple and effective means to evoke this wave. Recently, they have even successfully studied and set up many kinds of equipment to evoke Qigong. All have a close relation to resonance.

#### Five, Two Predictions

Theory not only can serve to put past experience into an order, but more importantly, it can forecast future phenomena. If they become proven, then the theory will have passed a severe test. Here based on Jing-luo and the Jingqi wave theory, we predict two new phenomena. We welcome everyone to examine them and see if they are correct.

1. Lower order organisms also have the Jing-Luo phenomenon.

As this phenomenon is shared by all cell groups and has no connection to the subdivision of cells, then not only do higher order animals and lower order plants have it, but so do even the simplest cell groups, those with only a few. Naturally, such groups can only travel on one Jing-Luo (liner connection between cells) with no possibility of turning back. But we predict that there is still a wave (let us call it a Qi wave) that moves around the cells. This can be regarded as the most primitive Jing-Luo state. In the next section, we shall use a simple model to analyze the wave activity in groupings with only two cells.

According to the above prediction, we suggest looking for Jing-Luo in lower order organisms, especially among those that have not yet developed circulatory and nervous

systems. If Jing-Luo exists, then we can use them to study the essential quality of Jing-Luo. This way we can avoid interference from circulatory and nervous systems and achieve more pure results.

## 2. Inner environment and cell vitality.

Biological vitality not only is connected with the organism but with its environment as well. Cells are similarly connected. Since cells generally are not exposed to natural environment, what directly affects them is the internal environment of the organism; let's call it simply the inner environment. This usually included chemical composition, temperature and internal pressure. Now we see that the resonance stress and electromagnetic fields are also important components. Possibly there are yet undiscovered elements or not yet considered important. Temperature, stress, electromagnetics all are fields. The entire inner environment is a field. We might as well call this a Qi field. The wave motion characteristic of an inner Qi is also that of the inner Qi field.

Under normal physiological conditions, the lack of physical, chemical and physiological uniformity of cells undergo cyclical changes. One can say that cells live in the process of resonance. As cells are living things, their resonance frequency rate can be regulated in a given range. But there is an ideal optimum rate for the highest biological vitality. To have effective resonance, cells need a responsive resonance from the Qi field. The inner Qi field's rate should desirably coincide with that of the biological vitality while maintaining an appropriate distance and scope. This kind of resonance inside and out will afford the cells the greatest vitality. An inner Qi field that leaves this ideal state will affect the cells' vitality. If it is too off balance, the cells will be damaged or even destroyed. This relationship between cells and the inner environment is what the ancients mean by "Heaven and Man as One."

At this point, we can see one of the mechanics of using Qigong to strengthen the body. While they are a complex matter, surely one of them is that the inner Qi field affords cells a suitable inner environment. Healthy cells vibrate to the best frequency rate. Many healthy cells in coordinated and consistent resonance produce an ideal inner qi wave which is the pure Qi wave. Of course, sick cells can vibrate abnormally, especially those that come from the sickness germs then are harmful resonances. These abnormal or harmful ones can evoke an abnormal inner Qi fields (waves). But if healthy cells could far outnumber sick cells, then the pure Qi of the inner Qi would be greater than the sick Qi. One then only need to have the pure Qi get near sick cells so they can have an ideal inner environment,

then they can be helped to regain health. When the pure Qi gets near the germs of sickness, it creates a hostile environment for them, and they can be restrained or even killed. Therefore, people in whom Jing-Luo passes freely do not get sick easily. Even if a small number of germs enter the body, they cannot find safe shelter or conditions conducive to growth.

#### Six, A Dipolar Molecular Model of A Double Cell

Generally, cells are electrically neutral. But inside the cell the distribution of electricity is uneven. Some places have more positive charges; others, more negative. In this section, we simplify a cell electrically as a dipolar molecule. In a normal state, the cell as such a molecule will undergo cyclical changes of various lengths. For simplification, we shall sum up these changes by saying that the charge does not vary but the distance between positive and negative charges changes cyclically. If we use the term Ying (negative) to describe the state when the molecule is greater than its average value and Yang (positive) when it is lesser, then the cyclical change can be pictured as a change in the rotation of Ying and Yang displacing each other (see Figure 3 below). When the cell changes from the

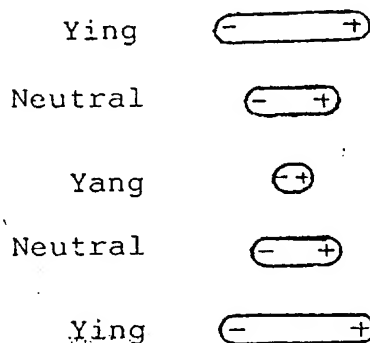


Figure 3. Single Cell Vibration

Yang to the Ying, the inner molecular energy increases to absorb the energy. One can see that this kind of definition of Ying and Yang conforms to the Ying-Yang doctrine that Ying rules the internal accumulation of enrichment while Yang governs external consumption requirements.

The resonant dipolar molecule can not only produce a static field, but a kinetic one. This induces the cell to radiate energy to the surroundings. For the cell, this depletes energy, but is vitally needed to live.

If two cells like the above join into a dual-cell group, could it then change its electromagnetic radiation? That depends upon the respective positions of the vibration.

When they vibrate with each other( see Figure 4), each



radiates energy roughly equal to that of a single cell. From an energy standpoint, neither one gains much.

But when the two vibrate against each other, since the kinetic fields farther out are mostly wasted, the energy is lessened, so comparatively little is needed to maintain normal life activity. This kind of symbiotic intergrowth might be one of the reasons single cells develop into multiple ones.

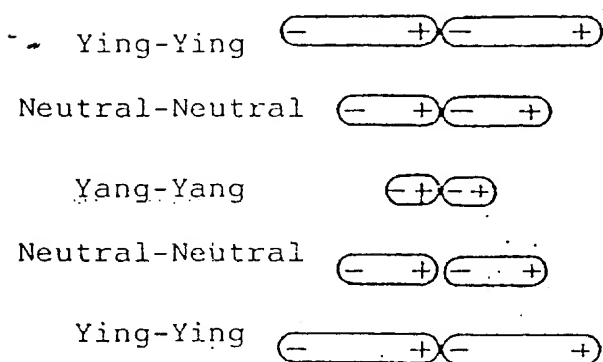


Figure 4. Double Cell Same Direction Vibration

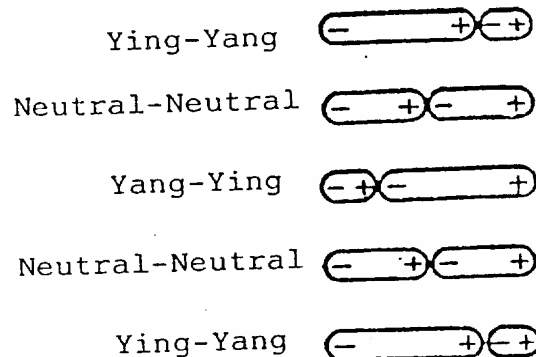


Figure 5. Double Cell Opposite Direction Vibration

Using words traditional to Chinese medicine and Qigong to describe the above, one says that the mutual vibration's characteristic is that at any given time, either Ying exists and Yang does not, or vice versa. This kind of imbalance between Ying and Yang is not ideal for life. The mutually exclusive vibration is characterized by both Yin and Yang existing all the time. This kind of commonly rooted equilibrium is ideal for life. One can see that while the expression can take different forms, the conclusion is consistent.

When the two cells vibrate against each other, at two kinds of activity go on inside the cell's linear connections. First the energy passes back and forth between the cells. Each local state resembles a single cell and the quantity of energy radiated is considerably reduced. Why? The quantity of energy radiated by one cell is largely absorbed by the other and only a small reaches far out and is lost. This kind of one emanating and one absorbing forms into a back-and-forth transmission of energy. There is a law in physics: when two pieces of matter pass energy back and forth, there is absorption and this clarified one of the reasons that cells join together.

Next, when two cells vibrate against each other, one dipolar molecule that does not change its size moves back

and forth along the linear connection. Look at Figure 5 where two cells form four electric charges. At the two ends the positive and negative charges do not move, forming no electromagnetic fields. In the middle, the distance between the other two is unchanged forming into a molecule straddling the two cells whose sizes do not change. Figure 5 shows that this straddling molecule moves to and fro. Kinetic fields come out of this.

As things move on the linear connection, this line can help us understand the primitive Jing-Luo and the moving things can help explain the essence of Qi.

While we simplified things through broad strokes, the double cell mutually exclusive vibration shown above preserves the basic characteristics of Qigong:

1. High Capability. The prerequisite of not reducing a single cell's vitality is low expenditure of energy. This can also be called the conscious state of low energy consumption.

2. The rule of coordinated consistency. The two-cell group has a mutually exclusive but in-step vibration. People are used to describe this as "orderly." But not every order necessarily benefits life. Only those that fit its requirements with a high degree of coordination and consistency can fit the ideal state of life.

3. Things that can be called Qi move back and forth along the routes in a definite manner.

From this we see that the double cell mutually exclusive vibrating model described above can be considered as the most simple and most primitive model of the Qigong state.

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MOLECULAR BIOLOGICAL EFFECTS OF EMITTED QI ON MAN

[Luo, Sen (Zhejiang Provincial Institute of Traditional Chinese Medicine); Chai, Shaoai; Yin, Weiyuan; (Zhejiang Provincial Institute of Medical Science); Ren, Hetian; (University of Zhejiang); Cao, Baozhen (Zhejiang Provincial Institute of Traditional Chinese Medicine)]

The "external qi" of qigong is an "internal qi" emitted from a human body which is under the functioning state of qigong at a fixed direction or multiple directions. It is one of the breakthroughs in the study of the traditional Chinese medical science--essence of qi, theory of qi, and mechanism of qi. Both clinical experience and experimental research have indicated that "external qi" is an existing form of an unknown material. Despite the fact that its structure and characteristics are still unknown to all, using modern experimental method may yet provide the basis of further research concerning various physiological effects of qigong's "external qi." Between 1982 and 1986, had conducted a research on molecular biology of qigong's "external qi" and body effect. The results are covered below:

I. Method of Experiment

(I) The Molecular Biological Effect of Qigong's "External Qi"

1. Object of Study and Method

Select an experienced qigong master to emit 2--5 min (5 min for CAMP Team; 2 min for T Lymph Team) of "external qi" from his Laogong acupoint at blood samples. Each emission will only cover 1--2 blood samples. The master will take a brief break before making the second emission. Blood samples for comparison purpose will be hung in the air for the same length of time without getting any emitted qi.

2. Items Under Observation

(1) Determine the CAMP content between the experimental team emitted with "external qi" and the team of comparison.

A healthy person's EPTA helps anticoagulation. The CAMP analytical medical box system is provided by the Atomic Energy Research Institute, Chinese Academy of Science. The analysis of CAMP conjugated protein is inspected and examined by the Medical Institute, Zhejiang Province.

(2) Determine the DNA combined effect of tip T Lymph cell between the experimental team emitted with "external qi" and the team of comparison.

A healthy man's heparin helps anticoagulation. Culture medium RPMI1640 is a Japanese product. <sup>3</sup>H-TdR is provided by Shanghai Atomic and Nuclear Research Institute, Chinese Academy of Science. EJ-353 liquid blinking instrument is a domestic product. The Medical Science Institute, Zhejiang Province is responsible for inspecting and examining the PHA stimulus and <sup>3</sup>H-TdR infiltration method.

(II) Qigong's "External Qi" and Body Effect

1. Object of Study and Method

The object of study in the experiment conducted by this team is consisted of 10 persons, including two with malignant tumors, two with difficulty of reproducing platelet, one with chronic hepatitis B, and five with low platelet and white blood cells. The sex distinction is four males and six females, in an average age of 37.5 years. Luo Sen is the qigong master, who is using the Zhou Tian Ming Meng Gong. The master of the emitter (A) uses the index, middle and ring fingers of his right hand to emit the qi by lightly touching the "cun-guan-chi" of the receiver's (B) right hand (or left hand) (with the middle finger touching exactly the wrist bone and the artery. Both A and B must have 15 minutes of rest prior to the experiment. During the experiment, both will assume a sitting position. The emission lasts an hour each time (with A's three fingers stay put). Then, repeat the same thing to another receiver.

2. Items of Observation

Determine eight synchronized indexes concerning the blood cells of both A and B (1) before the emission, (2) during the emission, and (3) one hour after the emission. The eight indexes include white blood cell (WBC), red blood cell (RBC), hemoglobin (HGB), hemocell total (HCT), mean cell volume (MCV), mean cell hemoglobin (MCH), mean cell hemoglobin concentration (MCHC), and platelet (PLT). Zhejiang Provincial Institute of Traditional Chinese Medicine is responsible for the determination by using the D-900 blood cell analyzer, manufactured by the Segnoin-Turner Company of the United States.

II. Results of the Experiment

1. Qigong's "External Qi" Can Improve the Rate of Combining the CAMP of Plasma With Terminal Blood T Lymph DNA.

(1) Chart 1 indicates that after qigong's "external qi" has worked on the blood, it can cause the CAMP in the plasma to increase. After qigong master A has emitted the qi, the plasma's average CAMP volume increases by 6.0 pmol/ml than that of the team of comparison with an apparent difference. Qigong master B has raised it by 2.0 pmol/ml; while yinggong master C has not raised much (or no result at all).

(2) Chart 2 indicates that after qigong's "external qi" has worked on the blood, there is an apparent difference ( $p < 0.05$ ) between the team of experiment and the team of comparison, with a raise of the combination rate of the terminal T Lymph cell's DNA to (6.8 ~ 49.8%).

2. After the combined emission of qigong's "external qi", there are an apparent instant effect and after effect in the mechanism's terminal blood cells.

(1) Chart 3 indicates that 10 examples picked out of 16 tests have shown changes among the qi receiver's hemoglobin, white cells and platelet. The experiment of this team has shown that during the process the qi receiver's

hemoglobin zoomed to the maxim value of 4.1g%; white cells, 3600/mm<sup>3</sup>; and platelet, 55000/mm<sup>3</sup> separately. Statistical treatment indicates that the average value of white cells went up from 4493.35/mm<sup>3</sup> to 5187.50/mm<sup>3</sup> with notable difference ( $p < 0.05$ ); platelet, from 67100/mm<sup>3</sup> to 82300/mm<sup>3</sup> with much notable difference ( $p < 0.01$ ). Though the average value of hemoglobin did not show notable difference ( $p > 0.05$ ), it still showed a tendency of two-way adjustment. For 10 times its average value went up from 9.48g% before the emission of qi to 10.44g% during the emission of qi, with much notable difference ( $p < 0.01$ ).

(2) Seven examples picked out of 14 synchronized tests have shown that in receiving the qi the receiver's terminal hemogram showed a notable increase from before receiving the qi. The increase continued one hour after the receiver had received the qi, which indicated the after effect of qigong. For instance, the after value of the receiver's blood (in six examples) before/during/after the emission of qi was taking place were broken down as follows: RBC (10000/mm<sup>3</sup>), 288.3/298.5/303.0; WBC (1/mm<sup>3</sup>), 3750/4683.3/5113.3; HCT (volume in %), 28.5/30.7/30.8; HGB (g%), 9.91/10.3/10.5; MCV (um<sup>3</sup>), 105.8/107.5/107.5; MCHC (%), 34.5/33.9/34.0; PLT (10000/mm<sup>3</sup>), 6.3/7.6/8.8; MCH (%), 36.7/37.7/36.2.

After the emission of qi had been completed, the master's terminal hemogram showed a notable drop. The hemogram dropped furthermore after the second emission. Yet after the drop, the hemoglobin, the white cells and platelet showed a tendency of going back up. For example, master Luo Sen's hemogram before/during/and during the second emission indicated as follows:

BRC(1) 487/462/462	(2) 461/429/428
WBC(1) 7100/6300/6100	(2) 5900/5500/5200
HCT(1) 45.8/43.7/43.3	(2) 42.5/41.5/41.2
HGB(1) 15.5/14.7/14.4	(2) 14.2/14.2/12.8
MCV(1) 33.0/33.6/33.3	(2) 33.4/34.5/31.1
PCT(1) 8.8/7.8/8.6	(2) 6.9/6.7/9.0
MCH(1) 31.0/31.8/31.2	(2) 30.8/31.1/29.9
MCHC(1)	(2)

### III. Discussions

1. The experiment indicates that the emitted "external qi" within a certain space can increase the volume of CAMP and the combined effect of terminal T Lymph cell's DNA. It has proved the notable biological effect of the "external qi" of qigong on large biological molecules.

2. The experiment indicates that the emission of the external qi of qigong by touching the "cun, guan and chi" may cause the receiver's blood cells' indexes to continue to rise after receiving the qi and an hour later. Yet, after the emission of qi has been completed, the master's terminal hemogram indicates a notable drop, which explains the notable biological effect of external qi of qigong on human body. In addition, it also shows the features of after effect.

3. The experiment points out that human "external qi" can directly pass through the method of energy and information transmission. It can not only

create biological effect on large biological molecules in cells, but also can enhance the blood making system of a mechanism to produce an overall effect within a short period of time by causing the adjustment and change of metabolism of the organisms to take place.

4. Based on both molecule standard and overall standard, this research proves initially the interrelated effect between "qi" and "blood" in the theory of Chinese medicine. In addition, it not only has provided a modern basis for the Chinese medical theories on qi and blood including "qi circulates when blood circulates," and "qi is the commander in chief of blood, while blood is the mother of qi," but also has established an experimental basis for modern qi and blood models.

5. This research indicates that the "external qi" of qigong has its medical value whether it is emitted away from the object or it is emitted in close contact with the object. Yet to the master, it is necessary to keep in mind that the mechanism should be protected.

Chart 1      Impact of Qigong's "external qi" on the Volume of Plasma's CAMP

	Normal Value (Team of Comparison) pmol/ml Plasma	CAMP Value in pmol/ml plasma after qi is emitted		
		Qigong Master A	Qigong Master B	Yinggong Master C
Blood Donor 1	14.6	19.5	15.0	14.1
Blood Donor 2	16.2	22.0	19.5	17.3
<b>X±SD</b>	<b>15.3±0.9</b>	<b>21.3±0.7</b>	<b>17.3±2.2</b>	<b>15.7±1.5</b>



Chart 2      The Effect of Qigong's "external qi" on the DNA Combination  
of Terminal T Lymph Cells (PHA Stimulates  $^3\text{H}$ -TdRLT)

Blood Doner	Team of Comparison (cpm)	Team Emitted with "external qi" (cpm)	Improvement of DNA Combination Rate
	$X \pm SD$ 0.2ml blood	$X \pm SD$ 0.2ml blood	%
1	7919 $\pm$ 1774	11545 $\pm$ 1191	45.8
2	19198 $\pm$ 5779	22176 $\pm$ 839	15.5
3	17834 $\pm$ 3676	17316 $\pm$ 3679	8.3
4	57766 $\pm$ 9318	61703 $\pm$ 8163	6.8
*5	3800 $\pm$ 281	5693 $\pm$ 683	49.8
*6	8812 $\pm$ 675	10019 $\pm$ 976	15.0

\* indicates the cpm value between the team of comparison and the team emitted with "external qi" with both teams cultivated with 0.1ml of blood.

Chart 3 Receiver's Hemogram Changes Before and During Receiving the Qi

	WBC $\times 10^9 / \text{mm}^3$		HBG g%		PLT $10^9 / \text{mm}^3$	
	Before	During	Before	During	Before	During
$X \pm SD$	4493.75	5187.50	10.24	10.65	$6.71 \pm 4.44$	$8.23 \pm 4.80$
(n=16)	$\pm 1349.85$	$\pm 1708.36$	$\pm 3.43$	$\pm 3.45$		
p value	$p < 0.05$		$p > 0.05$		$p < 0.01$	
			*n=10(↑)			
			$p < 0.01$			

\* indicates no notable change in the receiver's average value of albumins. However, the average value in 10 examples still showed an increase from 9.48g% to 10.44g% from before to during the emission of qi ( $t=2.8295$ ,  $p < 0.01$ ).



Chart 1 A Hydrilla Branch

Chart 2 Mesophyll Cells in the  
Vicinity of the Vein  
100x

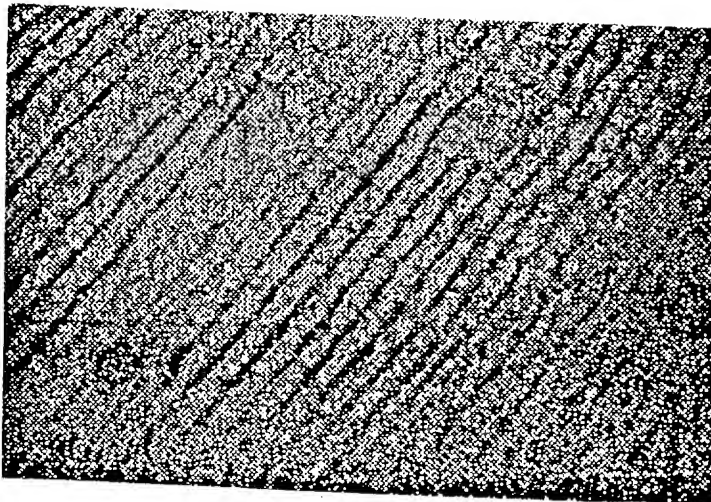
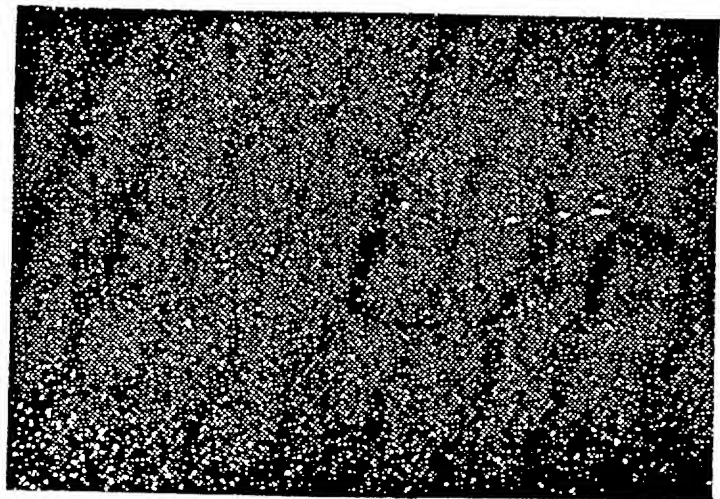


Chart 3 Hydrilla's Mesophyll Cells  
(The Dark Spots in the Cells  
are Chloroplasts.) 400x

### The Effect of Qi on the Stefan-Boltzmann Law

- Xie Huanzhang (Beijing College of Engineering)

(Translator's note: There are no section headings in the original text. As the paper is very long, for ease of reading section headings have been introduced.)

#### 1. Introduction

The Chairman of the National Scientific Association, the famous scientist Qian Xuelin, has said: "I believe that if the exceptional talents of the human body, Qigong and traditional Chinese medicine are combined, and once these come together with modern science and technology, then they can surely change into a Marxist science which is a correct science. At the same time, in the combining process, it can also transform modern day science and cause it to take another step forward. This will be a big task for us. After this task is completed, we will surely lead a great scientific revolution...this scientific revolution will be an eastern revolution.

Our experiments and research work have to a certain extent validated Qian Xuelin. The various physical laws concerning the non-living world have undoubtedly been proved within the scope of the activities of organisms that are considered

non-living/inanimate. But when we consider the activities of living organisms, especially under the action of Qi, many of these laws are clearly limited.

## 2. Background to the Experiment

One of the many manifestations of Qi, is where the Qigong Master emits energy from a palm with a comparatively low temperature and can cause objects to rise sharply in temperature. The temperature of the receiving objects is often higher to begin with than the palm emitting Qi.

To conduct research on this manifestation using the photon energy amount as a measure, we worked jointly with the Thermovision Laboratory of Quinhua University. We tested the transformation law between the palm temperature in a Qigong posture and the photon energy emitted from it.

The Thermovision was the AGA 780 model produced by the Swedish AGA Corporation. Its sensor and detector is made of InSb (Indium Antimony). After the short-wave lens of this detector receives 3 to 5 microns of infra-red radiation photon energy, it rotates the energy signals to become voltage signals which pass through a series of circuit rotation systems. Thus it can test the photon energy of an object and project

it to a color monitor screen. The Isotherm Unit (the voltage signal output of the device) will be called IU.

### 3. The Stefan-Boltzmann Law

The Stefan-Boltzmann Law formula is:

$$E_b = \sigma_b T^4 \text{ W/m}^2 \quad (1)$$

In the formula,  $\sigma_b = 5.67 \times 10^{-8} \text{ W (m}^2 \cdot \text{K}^4)$

This is known as the Stefan-Boltzmann constant.

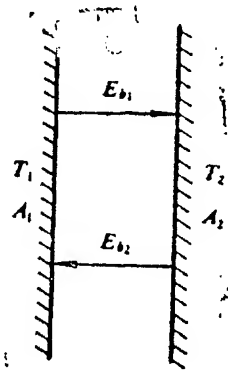
This equation shows that the quartic equation of the black body radiation  $E_b$  and its absolute temperature  $T$  has a direct ratio. This can also be called the Quartic Law. This equation also shows that when the temperature goes above absolute zero, the black body radiates energy. Moreover, when the temperature is different, the radiation changes.

The heat transmission radiation between two objects is also based on their geometric appearance, and is comparatively complex.

To look at it simplistically we employed 2 solid parallel surfaces and monitored the heat transmission radiation between them (see Illustration 1).

### Illustration 1

The heat transmission radiation of 2 flat surfaces



Both the flat surfaces are black bodies. Their surface area is comparatively large, and they are situated close to each other. Overlooking the heat transmission radiation from their edges, the energy radiating from the surface  $A_1$  is  $E_{b1}$ . Then, according to the Stefan-Boltzmann Law:

$$E_{b1} = A_1 \sigma T_1^4 \text{ (W)}$$

The energy radiating  $E_{b2}$  radiating from surface  $A_2$  is:

$$E_{b2} = A_2 \sigma T_2^4 \text{ (W)}$$

If  $T_1 > T_2$ , then  $E_{b1} > E_{b2}$ . But if we tally with the equal surface areas etc. of the two surfaces, then  $A_1 = A_2$ .

So the heat radiation amount between the 2 surfaces is:

$$Q_{b1} = A_1 (E_{b1} - E_{b2}) = A_1 \sigma_b (T_1^4 - T_2^4) (W)$$

The direction of heat transmission is from 1----→ 2.

If the temperature is reversed, and  $T_1 < T_2$ , then  $E_{b1} < E_{b2}$  and the radiation direction between the two will also be reversed from 2 ----- 1. It becomes:

$$Q_{b2} = A_1 (E_{b2} - E_{b1}) = A_1 \sigma_b (T_2^4 - T_1^4) (W)$$

If we take the Stefan-Boltzmann Law to be the heat transmission law between the two above-mentioned surfaces, then this also confirms the 2nd Law of Thermodynamics, which says that heat is always from objects of higher temperature to those with lower temperatures.

#### 4. Qi Radiation and the Stefan-Boltzmann Law

The temperature of the Qi palm and its radiation should normally conform to the Stefan-Boltzmann Law. Using the Thermovision, however, we saw a different pattern.

The demarcation curve provided by the device in Illustration 2 is in contrast with curve BC of the Stefan-Boltzmann Law. The Transformation Law between the radiation energy of the palm of a person not practicing Qi and its temperature does, nonetheless, conform with the Law.

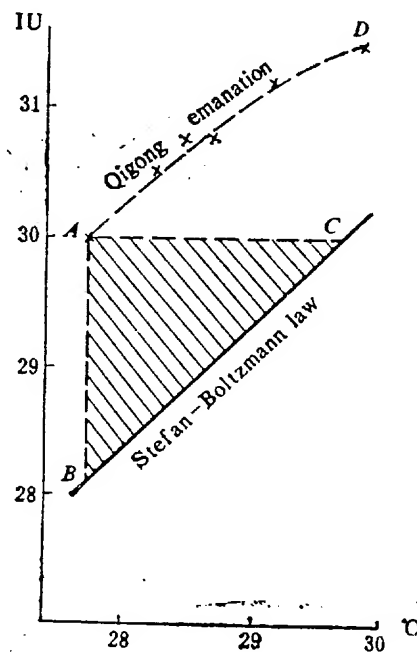
However, after 10 minutes of a Qigong practitioner entering



the Qigong posture, we measured the temperature of each part of his palm and the radiated energy (represented by IU) and curve AD in Illustration 2 appeared.

### Illustration 2

A comparison of the Qi Law and the Stefan-Boltzmann Law



The illustration shows that though there is a difference between the palm emitting Qi and one that is not, the heat transmission radiation in IU is much higher than that of the latter and that of ordinary objects.

Take Point A as an example. The temperature to the right

of Point A is higher than that of its position. Moreover, the IU of any point below AC is lower than that of Point A. thus, we have a dark triangle ABC. Any point on this triangle has a higher temperature but a lower IU value than Point A.

The numerical value of IU is in direct ratio to the photon number. Therefore, if an object at Point A is radiating energy to an object situated at any point in the triangle ABC, then the temperature of the object at Point A would be lower than the object receiving radiation. So the phenomenon of lower temperature radiating energy to higher temperature would occur.

Now comes the question of heat transmission radiation the Qigong palm compared to a non-Qigong palm. Illustration 3 shows a diagram of these two palms. The distance between them is very small. We can use the Stefan-Boltzmann Law to measure the heat radiation flowing out of the edges. This is because the blackness degree of the human skin is 0.97, making it very close to a black body.

In the diagram, the left palm with the absolute temperature  $T_1$  is that of the Qigong Master. The right palm with absolute temperature  $T_2$  is that of a person not practicing Qi.

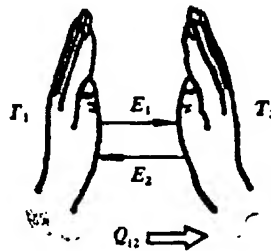
If the temperature of the former is lower than that if the

latter, then:

$$T_1 < T_2$$

### Illustration 3

The heat transmission radiation direction between the 2 palms



We can write out the Stefan-Boltzmann Law formula for the non-practicing palm as:

$$E_2 = \sigma T_2^4 \text{ (W/m}^2\text{)}$$

As for the Qigong Master's palm after he enters the Qigong stance, its energy radiation is beyond the Stefan-Boltzmann Law as represented by the line AD in Illustration 2.

Therefore, because the radiation energy amount of the Qigong Master's palm is:

$$E_2 = \sigma T_1^4 + f(Q_i) \text{ W/m}^2 \quad (2)$$

The  $f(Q_i)$  in the formula is the increased radiated energy

part corresponding to the line AB in Illustration 2. If the temperature difference between the two palms is very small, as corresponding with the region within BC, we can get:

$$\begin{aligned} & E_1 > E_2 \\ \text{then: } & \sigma T_1^4 + f(Q_i) > T_2^4 \end{aligned}$$

Due to this, the direction of heat transmission radiation is from the  $T_1$  palm to the  $T_2$  palm. Its single area heat transmission radiation amount is:

$$\begin{aligned} Q_{i2} &= E_1 - E_2 \\ &= \sigma (T_1^4 - T_2^4) + f(Q_i)W/m^2 \quad (3) \end{aligned}$$

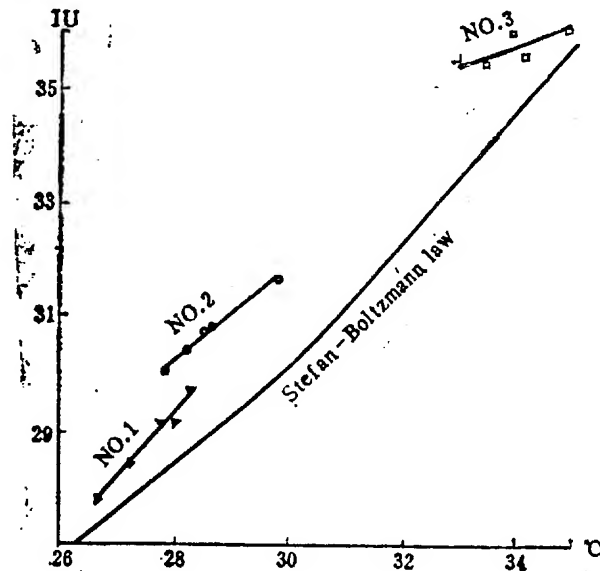
In the formula,  $f(Q_i)$  can be known as the Qigong Infra-red Radiation Function.

Due to the fact that the Qigong Master or his emission can might change, it is very difficult to come up with one common numerical value function.

To develop the experiment result shown in Illustration 2 even further, and to probe into the laws of Qigong infra-red radiation function, we used more people in the next experiment. According to the degree of the depth of Gongfu, that part of the energy emitted that goes beyond the Stefan-Boltzmann Law, i.e., the size of  $f(Q_i)$  is different for each master.

#### Illustration 4

A comparison between the Stefan-Boltzmann Law and the energy emission of 3 Qigong Masters



The  $f(Q_i)$  of Master 1 is small, but the temperature increase that follows is even more. The  $f(Q_i)$  of Master 2 is high, but the increase that follows is not as great as that of the Stefan-Boltzmann Law. Master 3's  $f(Q_i)$  is even higher, but the temperature increase is even lower.

Thus we can say that the transformation law of  $f(Q_i)$  is complex. However, the experiments do prove the existence

of the Qigong Infra-red Radiation Function  $f(Q_i)$ .

In the above experiment, the three masters used the same Qigong method.

In the next experiment, the masters used different methods of practice. This made the transformation law of Qi even more complicated. In some instances we got a negative value which appeared below the Stefan-Boltzmann Law curve. Moreover, this was not true for all of them. Due to this, we can postulate three conditions:

$f(Q_i) > 0$ , some methods of Qigong

$f(Q_i) = 0$ , tallies with Stefan-Boltzmann Law

$f(Q_i) < 0$ , some methods of Qigong

All in all, we can say that the Stefan-Boltzmann Law is true for heat transmission in inanimate objects. But with animate objects this law is clearly limited.

In the Qigong posture, the surface of the palm of a human being is much more complicated than the surface of an inanimate object. Affecting the skin surface there is sweat, circulation of the blood, the human nervous system, ionic bodies, the collateral channel system, etc.

To determine if we can develop a suitable use of the

Stefan-Boltzmann Law on both animate and inanimate objects, we wrote the following equation:

$$E_b = \sigma_b T^4 + f(Q_i)$$

When  $f(Q_i) = 0$  or  $0$ , it is suited to the animate Qigong stance. When  $f(Q_i) = 0$ , then it is suitable for the traditional Stefan-Boltzmann Law.

Whether the above formula can be called a first step in revising the Stefan-Boltzmann Law is a matter for further research.

As for the 2nd Law of thermodynamics, we did not know if the fact that in this experiment thermal energy was transmitted from low temperature objects to those of high temperature would violate the basic contents of this Law.

"Gelaoxiupei" says: "Any spontaneous process cannot cause the thermal energy from low temperature objects to be transformed to high temperature objects." Illustration 2 and 3 show that this manifestation was spontaneous and also accompanied by a compensation process, the Qigong process. In this accompanying process, the transmission of heat radiation from low to higher temperature objects was not a spontaneous but voluntary.

As to what matter gets consumed in the Qigong process, what

is the size of the compensation process, and how this relates to the macrocosmic mechanism of Qigong, these all are questions which invoke the relationship between spirit and matter. These questions also need research.

### 5. Conclusions

In conclusion, we would like to discuss three questions.

(1) A human palm is not an isolated system. It has a blood vessel system constantly bringing energy into the palm. Moreover, no two bodies are alike. If the energy supplied to the palm is great, can this not mean that the palm will be able to radiate more energy than another one with similar temperature?

We know that the Stefan-Boltzmann Law works with isolated objects or with single objects which have an energy link with the outside world. Any object, whether receiving heat from the outside or generating heat from the inside is subject to a predetermined proportionate relationship between its temperature and the thermal energy it radiates. This is the Stefan-Boltzmann Law.

Take for example an electric soldering iron. No matter how great the electric current which flows into the iron through



the wire, basically the temperature of the iron tip is in direct proportion to the amount of heat it radiates. Thus it is subject to the Stefan-Boltzmann Law.

For a majority of objects, the amount the thermal energy radiated is dependent on this temperature and not upon the amount of energy they receive.

(2) If an object can emit non-thermal radiation, it becomes part of a totally different work. The Stefan-Boltzmann law applies only to thermal radiation. The Thermovision cannot record non-thermal radiation. Could non-thermal radiation account for the anomalous results?

(3) The skin of living organisms is different from the surface of inanimate objects. For example it can various levels of transparency, making it possible that additional energy is radiated from the sub-surface. The skin of living organisms gave a degree of blackness of 0.97. But the same skin of a dead organism the blackness degree was only 0.46.

Whether this means that the soldification of protein has a relationship with the reduction of transparency or whether the 0.97 degree of blackness is a combination of the surface and energy radiation from a certain depth below the skin,

these are questions requiring further study. They will enter the realm of the study of the thermodynamics of living beings.

**The Statistical Treatment of the Experimental  
Results With Emitted Qi**

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of the Chinese Academy of Science)

**1. Raising Questions**

A new manifestation or law can be confirmed only if it can be duplicated sufficient times for statistical confirmation.

These needs are not met in Qigong experiments as these are small sample experiments. The Qigong Masters cannot exactly duplicate their emissions and energy release is exceptionally depleting of their physical, mental and emotional energies.

Understandably, Qigong experiments are then greeted with skepticism. We tried to approach the problem from the angle of mathematical statistics.

**2. Statistical Test Methods**

The first phase of our work tackled the statistical significance of experiment results using the "Hypothesis Test" method and the significance test method to deal with the problem of small number experiments.

The second phase used the "Parameter Estimation" statistical method. It was necessary to determine the numerical value of every characteristic of the new manifestations and estimate

its deviation level

### 3. The Context of the Experiments

Scientific research on Qi has been conducted only for 10 years. Though remarkable discoveries have been made, the goal is yet the discovery of new manifestations which can lead to the establishment of theoretical Qigong laws.

For research on new discoveries the statistical significance test method is suitable.

### 4. Confirming New Manifestations: the Statistical Significance of Abnormal Examples

The standard method of determining whether new manifestations are merely statistical fluctuations is the size of the significance level "a". If no new manifestations are discovered, the appearance of "a" is probably only a statistical fluctuation.

Take for example a physical value  $x$  with an average value

. After being surveyed many times, it is clear that  $x$  follows the normal distribution  $N(x, \mu, \sigma^2)$  where  $\sigma$  is the standard deviation. The significant deviation of the average value is  $x^*$ . Using  $S$  for the significance, we have:

$$S = \frac{x^* - \mu}{\sigma}$$

If the deviation  $x^*$  of the average is equal to one  $S$  standard deviation, the significance level becomes:

$$a = N(S; 0, 1)$$

$N(x; 0, 1)$  is the distribution function of the standard normal distribution. Then in a situation where  $x$  follows the normal distribution, the probability of  $\frac{x^* - \mu}{\sigma}$  occurs.

Table 1 shows the relationship between  $S$  and  $a$ . When  $S \geq 5$ , then  $a \leq 6 \times 10^{-7}$ . Thus the existence of new manifestations, from the statistical probability view, is highly likely.

Table 1

The relationship between  $S$  and  $a$

$S$	1	2	3	4	5	6
$a$	0.32	0.086	$2.6 \times 10^{-3}$	$6.4 \times 10^{-4}$	$5.8 \times 10^{-5}$	$2.0 \times 10^{-6}$

In the significance test method, it is important to understand the background fluctuations and note their statistics.

In the first period of the appearance of new manifestations, only a few examples may occur. Only the degree of significance should be high: it is unnecessary for the same degree of high significance to appear in each experiment. Therefore, Qi action need not produce identical effects in every experiment.

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This is a common technique in modern science. For example, in 1983 the Western Europe Nuclear Research Center announced the discovery of the  $Z^0$  nucleus after finding only 5 examples. In 1964 the US Brookhaven National Laboratory announced the discovery of the  $\Omega$  hyperon with only one example. It was 4 years before another example was found, by the Western Europe Nuclear Research Center.

#### 5. One Qi Example

In 1987, we conducted a Qi emission experiment on calf pleura DNA. After emission, the specimens were tested with an ultraviolet spectrophotometer to measure the absorption changes in the 257 nm position. The instrument's measurement precision was +/- 0.001. We tested 5 specimens and all showed substantial Qi effect. We chose 3 samples as examples for statistical analysis. (See Paper 12, Tables 2 and 3.)

##### 1. Understanding the background

(a) Increased heat (80+ degrees C), changes in the acidity level of the solution, or the addition of organic solvents of some types can cause the DNA solution to change. As a result the 257 nm position UV absorption increases (hyperchromic effect). In our experiment, once the DNA had passed through

the centrifuge, only deionized water was added to dissolve it. To avoid heat changes experiments were conducted at room temperature.

(b) When the temperature of the DNA specimen is raised by 10%, absorption increases by 2%. The experiments were conducted at night after central heating had been turned off and the room temperature had dropped to 23 degrees C.

The specimens were measured immediately after energy emission. This process took a minute, after which the specimen was removed for another emission.

While specimens 2# and 4# were being experimented on, specimen 3# acted as the contrast. Its absorption did not change.

Thus, neither room temperatures or equipment temperatures could have affected the specimens.

Some of the original DNA solution was used as contrast to specimen 12. (Translator's note: this is not an error and is the first mention of specimen 12 in either paper.) The specimen was even kept in sunlight without absorption changes.

## 2. The significance of the example

In the 2 hours before the experiment, DNA specimen 2# was tested twice. The standard deviation of the absorption value

was  $\pm 0.006$ . After the second energy emission, the sample's absorption significance increase to 18, as compared to  $S = 8$ . After the third time it increase further to 30.

Specimen 4# was placed in a small lead container and put right next to specimen 2#. The change in absorption was smaller. Significance  $S$  rose to 5 after the first emission, and then to 10 and 18 subsequently.

Specimen 12# was tested 5 times in the 2 hours before energy emission. Results show that the specimen that the specimen was stable, and the standard deviation was  $\pm 0.002$ .  $S$  rose to 6, 11 and 31 after the three energy emissions.

The measurement results of  $S$  being so high show that Qi action can increase the absorption in DNA. The hyperchromic effect points to the opening up of the double-helix of the DNA and a break in the hydrogen bond helix.

#### References

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